

Roosevelt Wild Life Bulletin

OF THE

Roosevelt Wild Life Forest Experiment Station

OF

THE NEW YORK STATE COLLEGE OF FORESTRY
AT SYRACUSE UNIVERSITY



RELATION OF BIRDS TO WOODLOTS

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Roosevelt Wild Life Bulletin

VOLUME 4, NUMBER 1

OF THE

Roosevelt Wild Life Forest Experiment Station

OF

THE NEW YORK STATE COLLEGE OF FORESTRY
AT SYRACUSE UNIVERSITY



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THE RELATION OF FORESTS AND FORESTRY TO HUMAN WELFARE

"Forests are more than trees. They are rather land areas on which are associated various forms of plant and animal life. The forester must deal with all. Wild life is as essentially and legitimately a part of his care as are water, wood and forage. Forest administration should be planned with a view to realizing all possible benefits from the land areas handled. It should take account of their indirect value for recreation and health as well as their value for the production of salable material; and of their value for the production of meat, hides and furs of all kinds as well as for the production of wood and the protection of water supplies.

"Unquestionably the working out of a program of wild life protection which will give due weight to all the interests affected is a delicate task. It is impossible to harmonize the difference between the economic, the aesthetic, the sporting and the commercial viewpoint. Nevertheless, the practical difficulties are not so great as they appear on the surface."

HENRY S. GRAVES,

Former Chief Forester, U. S. Forest Service.

Recreation, Vol. 52, p. 236, 1915.

RESEARCH ON WILD LIFE

"The discovery of new species and races based upon the study of preserved specimens of game animals, has already progressed very far; but the more attractive field which includes the habits of the game remains yet to a great extent unexplored. This field is peculiarly open for investigation to big-game hunters, and to all other men who go far afield and obtain first-hand knowledge of the conditions under which the game animals live. The closet naturalist, with his technical knowledge of the structure of animals, can be trusted to perform the work of classification to a mathematical degree of precision; but we cannot obtain from him a trustworthy account of the behavior of animals in their natural environment, or learn from him the value to the animals of the various structures or characteristics which he has shown them to possess. Much knowledge regarding the habits of game is acquired by the successful sportsman. Yet it is often infinitesimal in quantity compared to what may be acquired if the outdoors observer will direct his investigations along the broad lines covering the life history of the species with which he comes in contact. To carry out such investigations successfully it would be necessary to spend many hours and days, perhaps even weeks and months, observing certain individuals or family groups of game. This is quite beyond the limits of time allotted the average sportsman. Nevertheless much can be learned by the collected evidence from many fragmentary observations providing only these are accurate. A great mass of accurate fragmentary observations will often spell far more progress in investigations of this kind than the observations of a few trained individuals over an extended period of time."

THEODORE ROOSEVELT AND EDMUND HELLER.

Life Histories of African Game Animals,

Vol. 1, pp. vii-viii, 1914.



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PLATE 1. VIEW IN A TYPICAL NEW YORK WOODLOT
Showing conditions attractive to many kinds of woodland birds. Near Brant, Erie County.
Photo by T. L. Hankinson

THE RELATION OF BIRDS TO WOODLOTS IN NEW YORK STATE

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INTRODUCTION*

Most birds are born in trees, spend a great part of their lives in trees, and obtain much of their food from trees. It is clear, therefore, that they have the closest sort of relations with trees, and consequently with all aggregations of trees whether grove, woodlot, or forest. Trees and their products are indispensable to the national welfare, and every year as the visible stock decreases, the value of the remainder rapidly increases. The role of any group of organisms so closely related to the welfare of trees as are birds, is eminently worthy, therefore, of careful consideration and study. In the eastern States the relations of birds to trees is essentially a woodlot problem, for not only are most of our trees now in woodlots but the importance of woodlots in the general forestry program undoubtedly will steadily increase. The part that birds play in the welfare of woodlots may well become a factor in shaping woodlot practice.

Woodlots are of value in utilizing non-agricultural land, and in furnishing profitable employment for labor at slack seasons, in producing lumber and fuel for local consumption, in conserving the farm water supply, as a protection for crops, stock, and humans against winds, in furnishing shade for stock, and in generally increasing the value and attractiveness of farms.

In the Eastern States woodlots vary in size from about 5 acres in the older settled districts to about 180 acres in regions on the frontier of farming development. The average size is said to be around 30 acres. The productivity of such areas is by no means insignificant, but the great problem is marketing at a profit the timber crop of these numerous separated woodlots to which the usual big scale lumbering operations cannot be applied. However, this is a problem, which from sheer necessity, must be solved, and with that solution will come a higher valuation of woodlots that will justify employment of a system of woodlot management embracing all factors of importance. Among these undoubtedly will be the protection and semi-culture of useful birds, and the discouragement of injurious species.

*At the very beginning as becomes its importance, the indebtedness of the writer to Professor Elon Howard Eaton's "Birds of New York" (N. Y. State Mus. Memoir 12) is gratefully acknowledged. This comprehensive, scholarly, and magnificently formed memoir has been the source of basic data used throughout the present paper; it has been freely quoted also and the writer could advantageously have borrowed even further from Professor Eaton's lucid and authoritative work.

In New York there are twelve million acres, two-fifths of the land area of the State, that cannot be profitably devoted to agriculture under present economic conditions. More than four million acres of this land is on farms; in other words, now is or should be in woodlots. This woodlot area, so situated that its proper care can easily be made a part of the regular farm practice, should be producing timber at the maximum rate. It has been estimated that the woodlot area of the State can produce a billion board feet of lumber annually. Woodlot owners should be impressed with the value of such a production and with what they are missing by failing to participate in it.

Holders of woodlots in New York, being close to a large market able to pay top prices, should take the lead in applying advanced woodlot policies. The purpose of this paper is to reveal the part played by the bird population of woodlots, to demonstrate the advantages of taking birds into consideration in woodland management, and to show how this can in fact be accomplished.

KINDS OF BIRDS FREQUENTING WOODLOTS

By no means all of the birds occurring in New York can be termed woodlot species. In fact many of them, including most of the numerous groups of water- and shore-birds, will rarely or never be seen about the average woodlot. In addition to these groups, the grassland birds and the denizens of deep forests also scarcely need to be considered in a dissertation on birds of the woodlot.

In selecting the birds to be treated in this paper, the following criteria were observed. First, no bird is included in the list of summer residents of the woodlot unless it is a regular and fairly common breeding species; next, breeders solely of the deep forest, as the Pileated and Three-toed Woodpeckers, Yellow-bellied Flycatcher, and Canada Jay, are omitted, as are also those practically confined to swamps, as the Great Blue, and Green Herons, the Alder Flycatcher, Tree Swallow, Mourning Warbler, and the like; those which only temporarily resort to woodlands for nesting sites or cover, as the Mourning Dove, Bobwhite, and Sparrow Hawk; those practically confined to extreme southeastern New York where there are few woodlots, as the Carolina Wren and Cardinal; and finally, all birds of more open situations. These restrictions account for absence of the names of some very common birds, as the Kingbird, Phoebe, Starling, Meadowlark, Crow Blackbird, Chipping Sparrow, and the Swallows.

SEASONAL CHANGES IN WOODLOT BIRD LIFE

Considering the whole State there are in New York some 70 regular, fairly common to abundant birds, which are summer residents of woodlots (see Table, pp. 12-13). This is somewhat less than 70 per cent of all species nesting in the State, but is a good proportion considering that all grassland, marsh, and swamp species are excluded from the woodlot list, besides those species which are rare, or restricted in occurrence to very limited districts of the State.

In spring and fall each year woodlots as well as other suitable environments throughout the State are traversed by a flood of migrating birds, many of them of species that breed also within the State, which either nest to the North, or winter south of New York. In number of individuals these migrants far exceed the breeding bird population and for approximately a month and a half at each migrating season, the insect pests of woodlots must face an attack of multiplied intensity by the highly insectivorous birds that chiefly constitute these transient armies.

About three dozen species of the breeding woodlot birds spend the winter also in New York, and they are joined during the bleaker quarter of the year by a few hardy visitors from the North.

Putting the above generalities into the specific form of lists of woodlot species, we have the following:

RESIDENTS

Ruffed Grouse	Purple Finch
Ring-necked Pheasant	Red Crossbill
Sharp-shinned Hawk	White-winged Crossbill
Cooper's Hawk	Pine Siskin
Red-tailed Hawk	White-throated Sparrow
Red-shouldered Hawk	Junco
Long-eared Owl	Song Sparrow
Barred Owl	Cedar Waxwing
Saw-whet Owl	Myrtle Warbler
Screech Owl	Winter Wren
Great Horned Owl	Brown Creeper
Hairy Woodpecker	Red-breasted Nuthatch
Downy Woodpecker	White-breasted Nuthatch
Yellow-bellied Sapsucker	Chickadee
Red-headed Woodpecker	Golden-crowned Kinglet
Flicker	Hermit Thrush
Blue Jay	Robin
Crow	Bluebird

SUMMER RESIDENTS

Species occurring in summer and breeding within the borders of the State.

Broad-winged Hawk	Nashville Warbler
Yellow-billed Cuckoo	Parula Warbler
Black-billed Cuckoo	Black-throated Blue Warbler
Whip-poor-will	Magnolia Warbler
Hummingbird	Chestnut-sided Warbler
Crested Flycatcher	Blackburnian Warbler
Olive-sided Flycatcher	Black-throated Green Warbler
Wood Pewee	Pine Warbler
Acadian Flycatcher	Oven-bird
Least Flycatcher	Kentucky Warbler
Cowbird	Yellow-breasted Chat
Baltimore Oriole	Hooded Warbler
Chewink	Canadian Warbler
Rose-breasted Grosbeak	Redstart
Indigo-bird	Catbird
Scarlet Tanager	Brown Thrasher
Red-eyed Vireo	House Wren
Yellow-throated Vireo	Wood Thrush
Blue-headed Vireo	Veery
Black and White Warbler	Gray-cheeked Thrush
Blue-winged Warbler	Olive-backed Thrush
Golden-winged Warbler	

TRANSIENTS

Species which pass through the State in migration but which neither breed nor winter (customarily) within its limits.

Fox Sparrow	Bay-breasted Warbler
Philadelphia Vireo	Wilson's Warbler
Cape May Warbler	Ruby-crowned Kinglet

WINTER VISITANTS

Species found in New York only in winter.

Goshawk	Evening Grosbeak
Snowy Owl	Pine Grosbeak

GEOGRAPHIC DISTRIBUTION OF BREEDING WOODLOT BIRDS

Of the kinds of birds that may fairly be placed on the roster of woodlot nesting species, some occur only in the southeastern part of the State, others only in the mountainous sections, while still

others are of more general range. These facts are conveniently expressed by reference of the species to faunal areas, or life zones as they are sometimes called. For the purposes of this paper only three faunal areas need to be considered. They are the Carolinian Faunal Area which in New York includes most of Long Island, and the Hudson River Valley north to Saratoga County; the Canadian Faunal Area covering the higher parts of Cattaraugus, Allegany, and Steuben Counties, and the Catskill and Adirondack regions; and the Alleghanian Faunal Area embracing the remainder of the State. These definitions must be understood in a general sense only, for there is overlapping of the faunas of the various areas in every direction, and few birds are entirely restricted to the faunal area where they are most abundant. The common breeding birds of these three faunal areas that from their habits may properly be called woodlot species are listed and their distribution indicated in the following tabulation. There are 77 in all.

BREEDING BIRDS OF WOODLOTS OF THE FAUNAL AREAS OF NEW YORK

Species	Carolinian	Alleghanian	Canadian
Ruffed Grouse	+	+	+
Ring-necked Pheasant	+	+	—
Sharp-shinned Hawk	+	+	+
Cooper's Hawk	+	+	+
Red-tailed Hawk	+	+	+
Red-shouldered Hawk	+	+	—
Broad-winged Hawk	+	+	+
Long-eared Owl	+	+	—
Barred Owl	+	+	+
Saw-whet Owl	—	—	+
Screech Owl	+	+	—
Great horned Owl	+	+	+
Yellow-billed Cuckoo	+	+	—
Black-billed Cuckoo	+	+	—
Hairy Woodpecker	+	+	+
Downy Woodpecker	+	+	+
Yellow-bellied Sapsucker	—	—	+
Red-headed Woodpecker	+	+	—
Flicker	+	+	+
Whip-poor-will	+	+	+
Hummingbird	+	+	+
Crested Flycatcher	+	+	—
Olive-sided Flycatcher	—	—	+
Wood Pewee	+	+	+
Acadian Flycatcher	+	—	—
Least Flycatcher	+	+	+
Blue Jay	+	+	+
Crow	+	+	+
Cowbird	+	+	—
Baltimore Oriole	+	+	—
Purple Finch	+	+	+

BREEDING BIRDS OF WOODLOTS OF THE FAUNAL AREAS OF NEW YORK
(Continued)

Species	Carolinian	Alleghanian	Canadian
Red Crossbill	—	—	+
White-winged Crossbill	—	—	+
Pine Siskin	—	—	+
White-throated Sparrow	—	—	+
Junco	—	—	+
Song Sparrow	+	+	—
Chewink	+	+	—
Rose-breasted Grosbeak	+	+	+
Indigo-bird	+	+	—
Scarlet Tanager	+	+	+
Cedar Waxwing	+	+	+
Red-eyed Vireo	+	+	+
Yellow-throated Vireo	+	+	—
Blue-headed Vireo	—	—	+
Black and White Warbler	+	+	+
Blue-winged Warbler	+	—	—
Golden-winged Warbler	+	—	—
Nashville Warbler	—	—	+
Parula Warbler	+	+	+
Black-throated Blue Warbler	—	—	+
Myrtle Warbler	—	—	+
Magnolia Warbler	—	+	+
Chestnut-sided Warbler	+	+	+
Blackburnian Warbler	—	+	+
Black-throated Green Warbler	+	+	+
Pine Warbler	+	+	—
Oven-bird	+	+	+
Kentucky Warbler	+	—	—
Yellow-breasted Chat	+	—	—
Hooded Warbler	+	+	—
Canadian Warbler	—	+	+
Redstart	+	+	+
Catbird	+	+	—
Brown Thrasher	+	+	—
House Wren	+	+	—
Winter Wren	—	—	+
Brown Creeper	—	+	+
White-breasted Nuthatch	+	+	—
Red-breasted Nuthatch	—	—	+
Chickadee	+	+	+
Golden-crowned Kinglet	—	—	+
Wood Thrush	+	+	—
Veery	+	+	—
Olive-backed Thrush	—	—	+
Hermit Thrush	—	—	+
Robin	+	+	+
Bluebird	+	+	+

HABITAT ASSOCIATIONS OF WOODLOT BIRDS

The preceding list of characteristic breeding species does not inform the woodlot owner of the assemblage of birds he will probably have in woodland of a given type or in a certain state of develop-

ment. What these birds will be depends of course to some extent upon the part of the State in which a woodlot is situated, but this factor may be checked by reference to definitions of the various faunal areas on page 12. The local distribution of New York birds according to types of habitat has been well stated by Professor Elon Howard Eaton in his valuable work on the Birds of New York, and we can do no better than quote his statement of the matter ('14, pp. 20-23), as follows.

"Community of the pond and stream margins.* It has often been noted that many species are practically confined to pond shores and stream courses although they are not called aquatic species, and it might be said that the presence of streams and bodies of water is unquestionably a factor which attracts nearly all species of birds to a greater or less extent, but those confined to the immediate margins of ponds or streams are the American merganser (in hollow trees), Red-breasted merganser (nesting among the grass or low shrubbery), Hooded merganser (in hollow trees), Green heron (nesting among the lower trees), Spotted sandpiper (nesting among the grass and weeds), Belted kingfisher, Bank swallow and Rough-winged swallow (nesting in banks), the Phoebe (on ledges and bridge beams), Tree swallow (in hollow trees), the Alder flycatcher, Rusty blackbird, Lincoln sparrow and Northern yellowthroat (in bordering thickets).

"Community of the wooded swamp. These birds are related to the marshland and stream margin species on one side and to the forest society on the other, but characteristically seem to prefer wooded country of considerable extent covering damp or flooded land. Here are included the Black duck, Wood duck, Great blue heron, Black-crowned night heron, American woodcock, and Water thrush.

"Communities of the deciduous forest. Under this heading we might make several subdivisions, as, first, those preferring the *mature mesophytic forest*. Here might be included the Red-bellied woodpecker, Green-crested flycatcher, Crested flycatcher, Yellow-throated vireo and Cerulean warbler. In the same kind of forest, but determined by more or less dense *growth of underbrush* may be found the Black-throated blue warbler, Mourning warbler, Ken-

*As noted in previous pages, the birds of aquatic habitats are not considered woodlot species, hence are not given detailed treatment in this paper. In connection with his lists for other habitats, also, Professor Eaton mentions certain rare, local, and other species which for reasons stated on pp. 9, 10, are not embraced in the conception of characteristic woodlot birds of New York State adopted in the present report.



Fig. 1. A typical woodlot in eastern New York. View along valley of Queensboro Brook, Palisades Interstate Park. Photo by T. L. Hankinson.



Fig. 2. Favorable conditions for shy woodland birds. View in the Big Basin forest, Allegany State Park. Photo by A. A. Saunders.



Fig. 3. Cooper's Hawk.

tucky warbler, Hooded warbler, Canada warbler and Redstart; and in swampy bottomlands and wooded stream-sides, the Louisiana water thrush; in the flooded bottomlands, the Prothonotary warbler. In the deciduous woodland, but also showing no objection to the presence of coniferous trees and sometimes preferring the mixed woodland, might be mentioned the Ruffed grouse, Cooper hawk, Red-tailed hawk (mostly on the higher ground and gully margins), Red-shouldered hawk (preferring swampy forests), Broad-winged hawk, Great horned owl, Long-eared owl, Barred owl, Saw-whet owl, Hairy woodpecker, Whippoorwill, Ruby-throated hummingbird, Wood pewee, Blue jay, Crow, Rose-breasted grosbeak, Scarlet tanager, Red-eyed vireo, Tufted titmouse and Chickadee.

"Communities of the open woodland. Here might be included the Mourning dove, Sparrow hawk, Screech owl, Downy woodpecker, Red-headed woodpecker, Northern flicker, White-breasted nuthatch.

"In scattered trees or bushes in fields and along the roadside nest the Kingbird, Cedar bird, Migrant shrike.

"Open woodlands with thick underbrush are characterized by such species as the Yellow-billed cuckoo, Black-billed cuckoo, Least flycatcher, Orchard oriole, Golden-winged warbler, Nashville warbler, Canada warbler, Yellow warbler, Catbird, Brown thrasher, Carolina wren, Wilson thrush.

"Communities of the thicket and forest margin. These are closely related to the open woodland communities which prefer dense underbrush, represented by such species as the White-eyed vireo, Black and White warbler, Worm-eating warbler, Golden-winged warbler, Blue-winged warbler, Yellow warbler, Chestnut-sided warbler, Prairie warbler, Maryland yellowthroat, Yellow-breasted chat, Field sparrow, Towhee, Cardinal, Indigo bunting, Catbird, Brown thrasher.

"Communities of the mixed and coniferous forests. Many of our species are almost never found except in woodlands with a fair admixture of coniferous trees or with a preponderance of them. To this group belong the Sharp-shinned hawk, Goshawk, Broad-winged hawk, Long-eared owl, Saw-whet owl, Yellow-bellied sapsucker, Whippoorwill, Blue jay, Blue-headed vireo, Brown creeper, Black-throated green warbler, Chickadee and Hermit thrush.

"Communities of the coniferous forest. Practically confined to the pine forests, especially those of pitch and red pine, is the Pine warbler. To the *spruce and balsam forests* belong the Canada

grouse, Arctic three-toed woodpecker, American three-toed woodpecker, Olive-sided flycatcher, Yellow-bellied flycatcher, Canada jay, Raven, American crossbill, White-winged crossbill, Pine siskin, Winter wren, Red-breasted nuthatch, Hudsonian chickadee, Golden crowned kinglet, Bicknell thrush, Olive-backed thrush, Myrtle warbler, and Black-poll warbler. Practically confined to spruce, pine or hemlock forests are the Magnolia warbler, Black-throated green warbler and Blackburnian warbler.

"Communities of the culture formations. The *shade tree and orchard* community includes a few species which have adapted themselves so much to civilized conditions that their breeding site is more confined to these situations than to the open woodland formation to which they probably belonged at the beginning. In this are included such species as the Kingbird, Baltimore oriole. Purple grackle, Bronzed grackle, American Goldfinch, Chipping sparrow, Cedar waxwing, Warbling vireo, Robin, Bluebird. This community is often joined by other representatives from the forest, especially from the open woodland, such as the Mourning dove, Screech owl, Downy woodpecker, Flicker, Least flycatcher, Cowbird, Orchard oriole, Purple finch, White-breasted nuthatch and Chickadee.

"The *garden and shrubbery* community is represented by the Song sparrow, Chipping sparrow and Yellow warbler. This is also frequently invaded by representatives from the orchards and shade trees as well as from the open woodland and thicket, such as the Catbird, Goldfinch, and Maryland yellowthroat."

While for the sake of completeness we have quoted in its entirety Professor Eaton's grouping of tree-frequenting birds, we do not treat in detail for reasons mentioned on page 9 most of the birds named in his sections on "Communities of the Pond and Stream Margins," of the "Wooded Swamp," scattered trees and bushes, the shade trees and orchards, and gardens and shrubbery. Most of the birds mentioned in the other sections, however, may be considered woodlot species.

If we ask just where in the woodlot we may expect to see the various species, we may turn again to Professor Eaton, who gives the following succinct statement of the matter ('14, pp. 16-17).

"Thicket stratum. In this are included all birds which usually nest in bushes or in small saplings, usually in tangles on the borders of woods and in the undergrowths of the forest. [See Pl. 3.] The nests are usually placed from one to eight feet above the ground. The characteristic representatives of this story are the Yellow-

billed cuckoo, Black-billed cuckoo, Alder flycatcher, Cowbird, Rusty blackbird, American goldfinch (often in trees), Field sparrow (frequently on the ground), Song sparrow (later broods), Cardinal, Indigo bird, Migrant shrike (often in low trees), White-eyed vireo, Yellow warbler (frequently in trees), Chestnut-sided warbler, Prairie warbler, Black-throated blue warbler, Myrtle warbler and Blackpoll warbler (in low spruces), Maryland yellowthroat (occasionally on the ground), Yellow-breasted chat, Hooded warbler, Redstart (occasionally), Catbird, Brown thrasher (sometimes on ground), Olive-backed thrush. I was surprised to note how few species had been entered under this stratum, because it seemed to me it would include by far the most of all the strata enumerated, but this impression is undoubtedly due to the fact that the layer is so frequently invaded by both terrestrial and by arboreal species which belong more characteristically in the lower tree stratum.

“Lower tree stratum. In this are included those birds that do not require so dense a covert for the nesting site as the thicket stratum, but prefer a moisture habitat in which the rate of evaporation is lower than in the tree-top story which follows. They are characteristically the birds of the shaded or lower branches of forests and groves, placing their nests from 5 to 35 feet above the ground. Here we might include the Green heron, Mourning dove, Sharp-shinned hawk, Ruby-throated humming bird, Kingbird, Wood pewee, Green-crested flycatcher, Least flycatcher, Bluejay, Orchard oriole, Purple finch, Goldfinch, Chipping sparrow, Rose-breasted grosbeak, Scarlet tanager, Cedar waxwing, Red-eyed vireo, Blue-headed vireo, Parula warbler, Magnolia warbler, Black-throated green warbler, Redstart, Golden-crowned kinglet, Wood thrush, Robin.

“Higher tree stratum or tree-top story. Many species included in the former story frequently invade the higher portions of the trees, especially trees which have not reached their maximum height in the forest; but as building more characteristically in this layer we might mention the Great blue heron, Black-crowned night heron, Cooper hawk, Goshawk, Red-tailed hawk, Red-shouldered hawk, Broad-winged hawk, Bald eagle, Fish hawk, Long-eared owl, Barred owl (occasionally), Great horned owl (frequently), Olive-sided flycatcher, Raven, Crow, Fish Crow, Baltimore oriole, Purple grackle, Bronzed grackle, Crossbill, Siskin, Warbling vireo, Yellow-throated vireo, Cerulean warbler, Blackburnian warbler, Pine warbler.”

WOODLOT BIRDS OF NEW YORK AND THEIR ECONOMIC RELATIONS*

In the following section, the largest of the paper, is given a systematic account, species by species, of the characteristic woodlot birds listed on pp. 10-11. In each case the common and scientific names are given, as well as the residential status of the species (whether truly resident, summer resident, transient, or winter visitant), some note of the local distribution and habitat preferences of the species in New York State, and an account, more or less detailed (in proportion to existing knowledge) of the food habits of the bird, especially in relation to the forest.

RUFFED GROUSE; PARTRIDGE. *Bonasa umbellus* Linnaeus.

Resident

The Partridge (Pl. 2) originally occurred in every county in New York but is now scarce or wanting in the more thickly settled ones. This bird prefers mixed woods, and must have undergrowth both for cover and for the berries and other vegetable food it yields. With that requirement filled the Partridge is a genuine woodlot species. It may be added also that there is no more attractive woodland denizen, and none more prized by the average citizen. The Partridge's relation to the welfare of the woodlot depends chiefly on two characteristics of its food habits, namely its fondness for buds, and its taste for insects. Half of the bird's food consists of browse (that is, buds and leaves), more than a fourth of it of wild fruits, and more than a tenth of various seeds. The buds of poplar, birch, and willow alone make up over a fifth of the Partridge's diet, but a variety of other buds and leaves are eaten including those of alder, hazel, beech, maple, ironwood, hornbeam, and apple. The consumption of apple buds by the Ruffed Grouse is another story and it must be confessed that this activity sometimes is indulged in to an injurious extent. However, no instances are known of real damage to forest trees by Grouse budding, and it is believed that the value of the Partridge as a game bird is so high that in most instances injury to apple trees can well be overlooked. Since the bird's feeding on buds, berries, leaves, and the like is more or less meaningless in relation to woodlots, our verdict on the bird must be based on its

* The data upon which these accounts of the individual species of woodland birds are based, are drawn very largely from the publications and the files of the U. S. Biological Survey. This storehouse of information on the food of birds has been accumulating since 1885, and is by far the largest and most valuable of its kind in the world.

consumption of insect food. Slightly more than ten per cent of the Partridge's diet is composed of insects, and most of them are injurious forms. Those of special interest in relation to woodlots are the oak-leaf caterpillars (*Datana*) upon which a number of observers have reported the bird to feed; the red-humped caterpillars (*Symmerista albifrons* and *Schizura concinna*), adults of flat-headed and round-headed wood borers, leaf beetles, carpenter and other ants, and larvae of pine and other sawflies (*Lophyrus*, *Nematus*). Another interesting portion of the diet of the Ruffed Grouse is composed of galls; these outgrowths which deform the leaves and twigs of trees are frequently eaten and this results in the destruction always of one and usually of a number of the minute insects which cause and inhabit them. Summing up, it appears that ordinarily the Ruffed Grouse is mildly beneficial in relation to woodlots; should its budding proclivities become too prominent in undesirable directions it might easily become injurious, as it actually has at times in relation to orchards. However, the great value of the species as a game bird undoubtedly offsets, as a rule, any shortcomings in its food habits.

RINGED-NECKED PHEASANT. *Phasianus torquatus* Gmelin.

Resident

For nearly 20 years the Conservation Department of New York State has distributed Pheasants and their eggs for stocking purposes. In addition numerous private game farms have been producing birds most of which have gone eventually into coverts within the State. In 1922 the State Game Farms distributed more than 11,000 Ring-necks and more than 104,000 of their eggs. In 1920 the bag of Pheasants in the State was over 62,000, about three-fourths as many as of Ruffed Grouse killed in the same season. The Pheasant doubtless is in the State to stay and so long as restocking operations are carried on, the species will become an increasingly important factor in the annual game bag.

Pheasants range in the open much more than do the Ruffed Grouse, hence are not so closely identified with woodlot ecology. They feed on the tubers of *Trillium*, the seeds of smartweed, fox-tail, wild millet and ragweed, and on the fruits of spice-bush, june-berry, wild grape, choke cherry, elder, roses, and hawthorns, the latter two chiefly in winter, but their chief sources of subsistence are the products of more open places. In fact they are sometimes seriously destructive to corn, potatoes, tomatoes, and grapes, and feed to some extent on various other crops. They pay for this dam-

age in part by feeding upon grasshoppers, crickets, and caterpillars (including the European corn borer). Whatever they eat they usually take in quantity and apparently the chances are about even so far as good or harm resulting from their activities is concerned. The game value of the Pheasant offsets some of its depredations, and if the species ever becomes unbearably destructive locally, hunting can easily be increased so as to force its numbers below the danger limit.

SHARPED-SHINNED HAWK. *Accipiter velox* Wilson.

Resident

This species is distributed throughout New York State and is common in the breeding season and abundant in migration. Along its favorite lines of flight hundreds may be seen on certain good flying days in fall. The Sharp-shin may be taken as a type of the group of hawks whose habits are responsible for the condemnation of birds of prey as a whole. This group includes three species: Cooper's Hawk, the Sharp-shinned Hawk, and the Goshawk. They are often spoken of as "darters," a name which expresses a characteristic difference in their manner of hunting from that of other hawks. They course over the country at great speed and capture their prey by sudden darts. The blue darters are long-tailed hawks, with comparatively short, rounded wings, but they should not be confounded with that other conspicuously long-tailed bird, the Marsh Hawk. The latter usually flies slowly and may be recognized by the longer wings and white rump. The Red-tailed, Red-shouldered, and other large hawks usually watch for their prey from some convenient lookout station or soar slowly over meadow and forest, watching for a chance to pounce upon their quarry. These hawks almost always seize their victims on the ground, while hawks of the darter group often take them in full flight. This difference is of course chiefly due to the character of the prey, the darters feeding almost exclusively upon birds, which usually must be caught on the wing, while the other hawks prey upon mice and other small mammals, snakes, and grasshoppers and other insects, which as a rule must be sought on the ground.

The prey of the Sharp-shin, day in and day out, is birds. Occasionally it devours such insects as grasshoppers, crickets, and dragon-flies, or such mammals as shrews and bats. Meadow mice and white-footed mice are rather frequently taken, and small rabbits rarely. Birds up to the size of the Meadowlark and Killdeer, the domestic pigeon and Sparrow Hawk are captured, and occasionally

a small chicken. But small birds are its steady diet, such common species as the English and Song Sparrows and the Robin suffering heavy losses. Woodland birds like the vireos, warblers and thrushes are common prey of the Sharp-shin, and for destroying these friends of the forest this little hawk must be set down as a special menace to the woodlots. It has already been publicly condemned for its general depredations upon useful birds.

COOPER'S HAWK. *Accipiter cooperi* Bonaparte.

Resident

Except where the killing off of the local birds prevents, Cooper's hawk (Fig. 3) breeds throughout the State. Like the Sharp-shin it is more common in the migrating season. It is a larger hawk than that species and has a rounded instead of a nearly square-tipped tail. Cooper's Hawk is a wary and elusive species, making rapid and unexpected appearances and disappearances; one observer has well characterized this behavior as "sneaky." This is the species usually meant by the term "chicken hawk," though one of the larger and comparatively inoffensive Red-shouldered Hawks or similar species is more apt to be pointed out as the culprit. Cooper's Hawk is by far the most destructive species we have to contend with, not because it is individually worse than the Gos hawk, but because it is so much more numerous that the aggregate damage done far exceeds that of all other birds of prey. It is strong enough to carry away a good-sized chicken, grouse, or cottontail rabbit. It is especially fond of domesticated doves and when it finds a cote easy of approach it usually takes a toll of one or two a day. Practically every stomach of Cooper's Hawk examined contained remains of wild birds or poultry. All of the upland game birds pay toll to its predatory capacities, including quail, pheasants, and grouse; among birds of prey it conquers and devours such species as the Sparrow Hawk, Pigeon Hawk and Screech Owl. Its staple food consists of birds a little larger than those preferred by the Sharp-shin, although such common kinds as the Song and English Sparrows seem to be about equally attractive to these feathered bandits. Some insects, as dragon-flies, crickets, and grasshoppers are consumed, as are also a few lizards, snakes, and toads. Among mammals, shrews, white-footed and meadow mice, and rabbits are occasionally taken, while red squirrels and ground squirrels are rather frequently captured. Cooper's Hawk thus makes some amends for its misdeeds, but it is too preeminently a bird killer to be protected.

GOSHAWK. *Accipiter atricapillus* Wilson.

Winter Visitant

Although there are a few records of this species breeding in New York, its characteristic status at present is that of winter visitant. Some winters only a few reach the State but in others it is fairly common, becoming a perfect scourge to the poultry yard and game coverts. The Goshawk is fierce and daring, and more powerful than Cooper's Hawk; in a word, is well equipped to take what it wants. Poultry suffers most from its predatory activities, with rabbits and game birds (including grouse, pheasants, and quail) next in preference. The Goshawk is so destructive that the owner of woodland stocked with game birds must destroy promptly every one of these hawks frequenting it or the game will be very soon depleted. Although the Goshawk preys also upon various rodents up to the size of the ground hog, it is too destructive to valuable birds to be shown any mercy.

RED-TAILED HAWK. *Buteo borealis* Gmelin.

Resident

This large hawk is quite handsome in the adult plumage which includes a bright rufous tail. It is easily recognized by this appendage when the sun shines through it as the bird soars in circles far overhead, a performance to which it is very prone. The Red-tail breeds in all parts of New York, is more numerous in the spring and fall migrations, and winters sparingly in the warmer counties. Mice, especially meadow mice, are its staple food, and as many as 6 have been found to be taken at a meal in each of a number of cases. Shrews are next on the furred portion of the Red-tail's bill-of-fare, and house mice, rabbits, and gray, red, and ground squirrels are frequently captured. Mammals taken in lesser numbers include moles, rats, white-footed mice, bats, and muskrats. Medium-sized to small birds are eaten rather freely, and poultry flocks are often pillaged.

A few quail, grouse, pheasants, and ducks fall a prey to Red-tails; and it is of interest to note that 5 of the birds examined in the Biological Survey had eaten Crows, as it is often said that nothing will eat crow. Of insect food taken by the Red-tailed Hawk, grasshoppers are a pronounced favorite. Seven of the large bird grasshoppers have been found in a single stomach, as have no fewer than 80 specimens of a smaller species. Caterpillars are eaten with fair frequency and beetles and dragon flies are occasionally consumed. The Red-tail takes snakes, frogs, and toads often enough



Drawn by Edmund J. Sawyer

PLATE 2. A RUFFED GROUSE FAMILY IN EARLY SUMMER

The scene is here idealized. The presence of the male, standing on guard, is only occasional at this time.

to show they are relished, and turtles and lizards rareiy. Among other items of food are crawfishes, millipeds, spiders, and carrion.

The Red-tail is a powerful hawk, able to take whatever it wants from the small animal population of the Eastern States, and there is no doubt that certain individuals become too much addicted to feeding on poultry or game birds. However, the elimination of such individuals can be accomplished without declaring war on the whole race. The well-behaved Red-tail is as surely an economic as it admittedly is a scenic asset.

RED-SHOULDERED HAWK. *Buteo lineatus* Gmelin.

Resident

This hawk is slightly smaller than the Red-tail and more inclined to keep to cover; thus it escapes the hostile movements of man just enough to make it a more common species. It breeds in all parts of New York except the Adirondack region and winters in small numbers in the southern and western districts. The Red-shouldered Hawk is about as fond of mice as the Red-tail, meadow mice being first on its food list, but house mice, white-footed, and pine mice also are captured. Again this bird agrees with its larger relative in making shrews its second item of preference among mammals; a variety of other furred creatures are taken but none of them in numbers; in size they range up to the opossum and rabbit. The Red-shoulder eats less than half as many birds as the Red-tail and rarely captures poultry. The birds eaten are mostly of the size of the Blue Jay and Flicker or smaller, but there is one record each from stomachs examined by the Biological Survey of the Quail, Pheasant, Sparrow Hawk, Screech Owl, and Crow. The Red-shouldered Hawk is much more fond of frogs, toads, salamanders, snakes, and lizards than the Red-tail; in fact it makes them staple foods; a few turtles also are eaten. This bird searches about wet places and even fishes a little; besides the numerous frogs captured many crawfishes are eaten, as well as a few fishes, tadpoles, and snails. Insects also are much depended upon by this hawk; dragonflies, cicadas and crickets being frequently, and grasshoppers and caterpillars commonly captured. One stomach contained 10 of the large bird grasshoppers, and another 46 hoppers of more ordinary size. Large green katydids and mantides or rear-horses also are occasionally devoured. The caterpillars eaten by the Red-shouldered Hawk, naturally, are of the larger sorts and include the elm sphinx (*Ceratomia amyntor*) and the hickory horned devil (*Citheronia regalis*); the latter species is the largest caterpillar occurring in

New York and may reach a size of 5 inches in length by an inch in diameter. Agricultural pests not previously mentioned that are preyed upon by the Red-shoulder include wireworms, cutworms, white grubs, mole crickets, and the potato beetle. The Red-shouldered Hawk has such a good record that individuals should not be killed except on the most convincing evidence of perverted behavior.

BROAD-WINGED HAWK. *Buteo platypterus* Vieillot.

Summer Resident

The name of this hawk suggests a large bird, but it is a misnomer as this species is the smallest of its genus in New York. Allied to the Red-tail and Red-shoulder it is smaller than either and the adults may be recognized by the broadly banded tail. The Broad-wing is a woodland bird and is the commonest hawk in the Adirondack region. Snakes and frogs are predominant in its bill of fare, and along with these are taken some toads, salamanders, lizards, turtles, and crawfishes. Birds are picked up now and then, but the Biological Survey has found no poultry in the stomach of any Broad-wing. Mice and shrews are captured but not to the same extent as by the larger hawks, while other mammals, as red and ground squirrels and rabbits, are merely sampled. Insects are the most frequent article of food of this hawk and beetles and their larvae are most numerous taken. Among them white grubs and the larvae of the giant root borers (*Priouus*) are notably injurious forms. Grasshoppers, both brown and green, are a favorite food, and crickets and cicadas are often captured. Caterpillars, especially the larger kinds, have a prominent place in the Broad-wing's dietary. The hickory horned devil (*Citheronia regalis*), the red-humped oak caterpillar (*Synumerista albifrons*) and the so-called American silkworm (*Telega polyphemus*) are well-known species devoured. By feeding on these and other large and destructive caterpillars, and by devouring many of the special enemies of birds, as the squirrels and climbing snakes, the Broad-winged and Red-shouldered Hawks square their accounts for a limited amount of bird destruction. They are generally useful as well as highly interesting denizens of our woodlands and should be left undisturbed so far as practicable.

LONG-EARED OWL. *Asio wilsonianus* Lesson.

Resident

Relative to the status of the Long-eared Owl in New York, Professor Eaton says: "It is one of our strictly resident species, and is not very uncommon about dense wooded swamps and hillsides in

most parts of the State, but is apparently uncommon in the Adirondack forests. Cedar and hemlock swamps, pine woods, and alder thickets are its favorite retreats" ('14, p. 112). Professor Eaton reports also that an examination by him of 129 stomach pellets cast by this species revealed the remains of 187 mice and 5 sparrows. Analyses of pellets and stomach contents of this species by the Biological Survey show that meadow and pine mice are its staple foods. White-footed mice come next on a numerical list, and birds follow. These are chiefly small kinds from the size of a thrush down, but there is one record of a Meadowlark being eaten. Other food taken by the Long-eared Owl includes numerous shrews, a few beetles—mostly the large root borers (*Prionus*)—and an occasional rat, mole, ground squirrel, rabbit, toad, frog, or lizard. The Long-eared Owl is not wary, hence often falls to the guns of hunters. However, it is a chiefly beneficial species and in most cases should be spared.

BARRED OWL. *Strix varia* Barton.

Resident

The Barred or Hoot Owl occurs throughout New York State wherever there is sufficient woodland to provide it with the necessary cover. It may be found at all seasons but is more numerous in spring and fall. Its hooting is familiar to all who are accustomed to spend the night in or near forests, as this owl indulges in vocal demonstrations more frequently than the other species. Although large and powerful enough to prey freely on poultry the Barred Owl seldom yields to the temptation. Only two instances were disclosed by the examination of nearly 200 stomachs in the Biological Survey. In fact the Barred Owl is not a conspicuous bird eater at all. Only a few small birds were represented in these stomachs, in addition to the following specimens of larger species: domestic pigeon, 1; Pheasant, 1; Ruffed Grouse, 2; and Screech Owl, 3. Meadow mice are the most important single item of food, but they are run a good second by shrews; the latter fact is scarcely to the credit of the owl for whatever economic importance shrews have is on the right side. White-footed and other mice are frequently eaten, more flying squirrels are captured than by other owls, and red and ground squirrels, rats and rabbits are occasionally devoured. Insects also are important as food of the Barred Owls, the principal groups taken being grasshoppers, beetles, crickets, and spiders. Adult and larval lepidoptera (caterpillars) also were sparingly represented in stomachs examined, and it is of interest to note that the elongated and spindle-legged walking-sticks occurred in 3 stomachs. Crayfishes, scaly

fishes and snakes are most important among the remaining items of food of the Barred Owl, and snakes, lizards, frogs, snails and earth-worms complete the list. The Barred Owl does not do so much harm as might be expected in view of its powers, does some good, and should be preserved except in the case of individuals that form bad habits.

SAW-WHET OWL. *Cryptoglaux acadica* Gmelin.

Resident

This little owl is so retiring in habit that it is seldom seen, but there is good evidence that it occurs regularly in most parts of the State of New York, and is fairly common in the Adirondacks. It is so unsuspicious that numerous specimens have been caught by hand, and its striking notes are unmistakable. Mice, especially the white-footed or deer mice that are as characteristic of woodlands as the bird itself, form almost the entire subsistence of the Saw-whet. A few shrews and small birds also are eaten, and a very few moths and spiders.

SCREECH OWL. *Otus asio* Linnaeus.

Resident

This is more common than any other owl in New York, spends the whole year in the State, and inhabits all parts of it except the spruce and balsam forests. An account of a special study of the food habits of the Screech Owl in New York has been published by Dr. A. A. Allen of Cornell University. This investigation covered the season when young were being fed, a period of 45 days. Remains of birds were found in the food on 35 of these days, insects on 28 days, crayfish on 24 days, amphibians on 15 days, mammals on 12 days, fish on 6 days, and spiders, snails, and reptiles on one day each ('24, p. 7). Ninety-eight birds of 24 species were brought to the young. Although it is probable that birds are not destroyed to anything like this extent at other times of year, the record is indeed a black one, and proves sufficiently that breeding Screech Owls are "undesirable citizens" where an effort is being made to increase the number of small birds.

In a general study of the food habits of the Screech Owl, based on the contents of nearly 450 stomachs collected throughout the year, the record of bird destruction is by no means so bad. The number of times birds were captured by these birds was 48, and 13 of the records are for the English Sparrow. Birds from the size of its own kin and

the domestic pigeon to Chickadees are eaten. Beetles occurred more frequently than any other food item in these stomachs, viz.: 151 records. Some special forest insects, as june beetles (*Phyllophaga*), the goldsmith beetle (*Cotalpa lanigera*), sapwood borer (*Hylobius pales*), and an oak borer (*Romaleum atomarium*), were included, the first two kinds in considerable numbers. Grasshoppers and crickets are next in rank to beetles in the insect food of the Screech Owl and a great variety of other arthropod forms are taken of which the most important are moths, caterpillars, spiders, and crayfishes.

Mice, including meadow mice, deer mice, and house mice without doubt were the largest element by bulk in the entire food of these 400 and more Screech Owls. A few shrews and house rats also were taken as well as a very few moles, flying squirrels, and wood rats. Miscellaneous items of food worthy of mention are frogs, lizards, turtles, earthworms, and myriapods. In general and at most seasons the Screech Owl probably does more good than harm but when it has clamorous young to feed and must get food quickly and in quantity, doubtless it preys more freely than is desirable upon small birds.

GREAT HORNED OWL. *Bubo virginianus* Gmelin.

Resident

Formerly, at least, the Great Horned Owl (Fig. 4) could be found in all parts of New York State. Man's hand has been against it since colonial times, however, so that its numbers are now greatly reduced. The survivors are mostly in deep forests where they live the year round. This owl is in bad repute with man because of competition for some of the same food items. Rabbits first and poultry next are the Great Horned Owl's staples, and these are wanted by man for himself. Except for these transgressions we would not condemn the bird severely. It takes a moderate number of birds other than poultry, including some small birds, and a few wild ducks, quail, pigeons, grebes, crows, and smaller owls. On the other hand it consumes a considerable number of meadow, deer, and other mice, and a few house rats and mice. Its other mammalian prey includes skunks, shrews, red, gray, and flying squirrels, muskrats, opossums, and bats. The Great Horned Owl eats numerous large insects, especially beetles. It takes the very largest we have in our fauna, as the stag and rhinoceros beetles. The food of these beetles as well as the large root borers (*Prionus*) is wood, though sometimes it is decayed. June beetles, both the adults and larvae of which are injurious to trees, are eaten, as are some of the large pine sawyers (*Monochamus*). Among other insects taken by this owl are grass-

hoppers, crickets, caterpillars, giant water bugs, and moths. Other objects of food are snakes, lizards, frogs, toads, salamanders, fishes, snails, and spiders.

SNOWY OWL. *Nyctea nyctea* Linnaeus.

Winter Visitant

Some Snowy Owls are observed in New York State every winter, but at intervals of a few years the species may be very numerous. The season when most of these birds are seen extends from early November to February. Field mice, of which 8 have been found in a single stomach, are the principal food of the Snowy Owl in New York, and some house rats and mice also are captured. The species is powerful enough to prey upon rabbits and grouse, which it does to a slight extent, but on the whole it probably does more good than harm while on its winter vacation.

YELLOW-BILLED CUCKOO. *Coccyzus americanus* Linnaeus.

Summer Resident

The Yellow-billed Cuckoo (Fig. 5) inhabits all parts of the State except the higher Catskills and Adirondacks, arriving from its winter home in early May and departing in October. Cuckoos, popularly called Rain-crows, are more familiar from their notes than from appearance. They have a way of remaining quietly concealed in foliage, or when moving, of slipping from place to place in a ghost-like manner, so that they are little observed. When the farmer or forester hears the strange calls of the Rain-crow, however, he can congratulate himself that a friend is near. Cuckoos never harm any crop or other possession of man, and except for eating a very few beneficial insects are exclusively useful in their food habits. Cuckoos are primarily caterpillar eaters and they care not whether this prey be large or small, smooth or hairy, or even armed with poisonous spines. All apparently are welcome. About half of the entire food of the Yellow-billed Cuckoo is made up of caterpillars and among them are some of the most notorious pests of trees. The better known kinds eaten by this bird include: Cankerworms (*Alsophila pometaria*), more troublesome in orchards, but fond of other trees, especially elm; green-striped maple worm (*Anisota rubicunda*) which sometimes defoliates its food plants; yellow-striped oak caterpillar (*Anisota senatoria*) a habitual stripper of scrub oaks and occasional feeder on the more valuable oaks (17 of these larvae were found in a single stomach); the poison-spined Io caterpillar (*Automeris io*) which makes noticeable depredations on a variety of deciduous trees;

yellow-necked appleworm (*Datana ministra*), a general feeder, found in 41 stomachs of the Yellow-billed Cuckoo in numbers as high as 30; black walnut caterpillar (*Datana integerrima*) of which the cuckoo has been known to destroy a local infestation; red-humped oak caterpillar (*Symmerista albifrons*) sometimes seriously injurious to oak and maple (one stomach contained 25); locust leaf-folder (*Epargyreus tityrus*) a defoliator of the common locust and other leguminous plants; fall webworm (*Hyphantria textor*) a perennial pest, well and unfavorably known to all (217 of these larvae were counted in a single stomach); the common tent caterpillar (*Malacosoma americana*) and the forest tent caterpillar (*Malacoma disstria*) both prime pests of deciduous trees (250 larvae of the former species were removed from one stomach; cuckoos almost live on tent caterpillars in the season and have been known to clean up local infestations of them); green oak caterpillar (*Nadata gibbosa*); the tussock caterpillar (*Hemerocampa leucostigma*) one of our worst shade tree pests (50 of these in a single stomach); American silkworm (*Telea polyphemus*) a large and voracious general feeder; and the spiny elm caterpillar (*Euvanesa antiopa*) a common pest of elms, and sometimes so abundant as to strip these and other trees, particularly poplars. Besides these caterpillars best known under names applied to the "worm" stage, larvae of the following moths and butterflies also are on the bill-of-fare of the Yellow-billed Cuckoo: gipsy moth (*Porthetria dispar*) and browntail moth (*Euproctis chrysorrhæa*), two of the very worst of ail woodland pests; American dagger moth (*Apatela americana*), a general feeder on deciduous trees; luna moth (*Tropea luna*), feeds particularly on walnut, butternut, and hickory, but also on other soft-leaved trees; eight-spotted forester (*Alypia octomaculata*), a pest to Virginia creeper and grape; the imperial moth (*Basilona imperialis*), a giant caterpillar fond of the foliage of pine as well as of maple and oak; and the violet-tip (*Grapta interrogationis*), sometimes abundant and destructive to elm. This is the notable array of caterpillar pests of woodlands upon which we know the Yellow-billed Cuckoo wages war, and without doubt numerous names could be added to it if the whole truth were known.

About three-tenths of the food of this bird consists of grasshoppers, katydids, tree crickets and related insects, the consumption of which is entirely to its credit. Beetles and bugs each contribute about 6 per cent of the subsistence of the Yellow-bill, among them various enemies of trees. Among the bugs, cicadas or dog-day locusts are the most prominent item; these are large morsels of food,

but apparently of a type the cuckoo loves to get, as 6 of them were found packed in one stomach. Probably the interrupted songs of cicadas we hear, ending in an abrupt squawk, in most instances mean the songster is just then being gobbled by a cuckoo.

The beetle dietary of the Yellow-bill is quite varied and comprises a number of the more injurious kinds. Long-horned wood borers, which as a class, are injurious, seem to be much to the taste of the cuckoo. Particular pests identified among the food are the oak borer (*Romaleum atomarium*) and the hickory twig girdler (*Oncideres cingulatus*). The closely related leaf beetles also are relished, among them the cottonwood leaf beetle (*Melasoma scripta*), a well known pest of willow and poplar; the locust leaf miner (*Odontota dorsalis*), which often blights locusts like fire; and species of the genus *Calligrapha* which feed on alder, willow, and wild plum. Mention of the potato beetle should not be omitted here even though it is not a forest insect. Leaf chafers of several groups also are devoured, as the June beetles (*Phyllophaga*), goldsmith beetle (*Cotolpa lanigera*), rose beetle (*Macrodactylus subspinosus*), and others of the genera *Anomala* and *Euphoria*. The adults of flat-headed wood borers, click beetles (parents of wireworms), nut weevils (*Balaninus*), and the New York weevil (*Ithycerus noveboracensis*) also are eaten. Sawfly larvae, often as abundant and destructive as any caterpillar, are freely devoured by the Yellow-billed Cuckoo, one kind identified from stomachs being a large species (*Cimbex americana*), the larvae of which feed on elm and willow. Other insects preyed upon by cuckoos include fireflies, tree hoppers, ants, wasps, dragon flies, mayflies, and dobson flies. Spiders and daddy-long-legs are frequently eaten by this Rain-crow, and a few other items of food that seem quite odd, as snails, and tree toads. All in all the food habits of the Yellow-billed Cuckoo are so exemplary that enthusiastic approval of them is certainly in order.

BLACK-BILLED CUCKOO. *Coccyzus erythrophthalmus* Wilson.

Summer Resident

The Black-billed Cuckoo is about as common as the Yellow-billed in southeastern New York, and slightly more common in other parts of the State. Its season of occurrence and its general habits are about the same as those of the Yellow-bill. Except that we have less information on this species it would probably be safe to say that the account of the food habits of the preceding species can serve as well for the Black-bill. Certainly this is true in general and we believe that in time and with the accumulation of further material



Fig. 4. Great Horned Owl.



Fig. 5. Yellow-billed Cuckoo.

the food of the Black-billed Cuckoo will be proved to be almost identical in character (in the same region) with that of its congener. Caterpillars then are this bird's special meat, and we know it feeds on the green-striped maple worm, the yellow-striped oak caterpillar, the Io caterpillar, common tent caterpillar, yellow-necked apple worm, red-humped oak caterpillar, spiny elm caterpillar, and larvae of the tussock moth and eight-spotted forester, at least, among the pests preyed upon by the Yellow-bill. The Black-bill agrees with its cousin also in a fondness for grasshoppers, crickets, and cicadas; and selects about the same line of beetle food. Long-horned and bronzy wood borers, June beetles, goldsmith beetles, rose beetles, and other leaf chafers, the cottonwood and other leaf beetles, and click beetles, are its favorites. Two sorts not found in stomachs of the Yellow-bill deserve mention, namely, the stag beetle, and the white pine weevil. As in the case of the Yellow-bill, spiders and daddy-long-legs are relished, and the out-of-the-ordinary dietary items also are about the same. There is no question but that the Black-billed is as praiseworthy, economically, as the Yellow-billed Cuckoo, and that is high commendation indeed.

HAIRY WOODPECKER. *Dryobates villosus* Linnaeus.

Resident

The Hairy Woodpecker (Fig. 6) is sometimes called "Big Sapsucker," but we shall see in the account of the Yellow-bellied Woodpecker that that species is the only true sapsucker in New York. The "Hairy," which occurs throughout the State, not only is no sapsucker, but is one of the very best friends of the forest. This is due chiefly to the consumption of wood-boring beetle larvae which compose more than three-tenths of the subsistence of the species. The round-headed borers are first in abundance among the Hairy Woodpecker's victims, and no fewer than 100 of these larvae have been taken from a single stomach. The lesser pine borer (*Ascmum moestum*) was one of the kinds eaten. Flat-headed wood borers were freely devoured also, 110 being found in the stomach of one individual. Engraver or bark beetles, prime pests of woodlands, are not neglected by the Hairy Woodpecker in its search for food, fifty of these insects sometimes being taken to a meal. The spruce bark beetle (*Polygraphus rufipennis*) a dangerous enemy of spruce in the Adirondacks, and one of the pernicious white-pine borers (*Tomicus caclatus*) were among the bark beetles taken. Another weevil (*Dorytomus mucidus*) boring in pine seems to be a favorite morsel of the Hairy, 109 being found in a single stomach. The fact that

wood-boring larvae compose from 21 to 41 per cent of the food in every month of the year, shows as Professor Beal has said "how earnest these birds are in their efforts to procure this kind of food. In summer insects and small fruits abound enough to satisfy appetite, and in variety apparently suited to every taste—but the birds still search for and obtain these wood-boring grubs to the extent of a fifth or more of their daily food, at the cost of hours of hard labor in digging them from the tree." ('11, p. 14.) (See Fig. 7.) Many other beetles are eaten by the Hairy Woodpecker and among them various forest enemies, as the click beetles, June beetles, and stag beetles.

Ants are the second ranking staple of this bird's diet, forming 17 per cent of the annual subsistence. Included among them are many carpenter ants (*Camponotus*) which hollow out and contribute to the destruction of numerous trees. Caterpillars make up nearly a tenth of the Hairy's diet, and include wood-boring as well as leaf-eating kinds. This woodpecker consumes a variety of other insect food of which grasshoppers are most prominent; forest insects included in this part of the bird's diet are plant lice, cicadas, white ants, pupae of the gipsy moth, tussock caterpillars, American silkworm, sawfly larvae, and scale insects. Among the latter is the plum scale (*Eulecanium cerasifex*).

About a fifth of the total food of the Hairy Woodpecker is derived from the plant world, chiefly wild fruits and mast. Most of the common berries and stone fruits are sampled, more of those of the poison sumachs being taken than of any other kind. Some corn is eaten, most of it waste, and more or less of the inner bark of trees is consumed incidentally to digging out wood borers. Professor Beal's summary of the food habits of the Hairy Woodpecker is: "that it is a bird from which the orchardist and forester have nothing to fear and much to gain. The quantity of useful insects or economic produce which it eats is insignificant. On the other hand the number of destructive larvae which it devours must have a very sensible effect in reducing the abundance of these pests." ('11, p. 17.)

DOWNY WOODPECKER. *Dryobates pubescens* Linnaeus.

Resident

By the same misapplication as in the case of the Hairy Woodpecker the Downy is sometimes called "little sapsucker." However, this bird's habits scarcely fit the name and it is as useful as its larger relative. The Downy is the most common woodpecker of the State and being of confiding disposition is the most familiar of the

species. It is present both in winter and summer. This little woodpecker is not so strenuous a hewer of wood as the larger Hairy, so gets fewer of the larvae of wood-boring insects. Nevertheless, its record in this respect is good, about a seventh of its food consisting of such prey. The ribbed pine borer (*Rhagium lineatum*) and the two-horned fruit borer (*Bostrichus bicornis*) are among those devoured. Mr. Forbush records it as feeding on the bronze birch borer, the maple borer and the white pine weevil, and the oak pruner ('07, pp. 254, 256). Weevils of many sorts are eaten, including the nut weevils (*Balaninus*), the gray-sided oak weevil (*Pandeletejus hilaris*), another oak weevil (*Cryptorhynchus ferratus*), and the same pine weevil (*Dorytomus mucidus*) taken by the Hairy Woodpecker. Fifty of these last named weevils were found in a single stomach. The engraver or bark beetles, a branch of the weevil alliance, are not neglected by the Downy Woodpecker. The most common ash borer (*Hylesinus aculeatus*) and the spruce timber beetle (*Xyloterus bivittatus*) are among the bark beetles eaten. Flat-headed wood borers and click beetles are other injurious beetles preyed upon by the Downy.

A fifth of the food of this little woodpecker consists of ants; as many as 200 of them have been found in a single stomach. About one-sixth of the total subsistence is made up of caterpillars and moths. The Downy is a great foe of the codling moth, eats the eggs of tent caterpillars, and has been observed to destroy the large cocoons of the Cecropia and Prometheus moths.

A variety of insects of the order Hemiptera conjointly make up nearly nine per cent of the food of the Downy Woodpecker. Of special interest among them in relation to forests are the scale insects, jumping plant lice, and ordinary plant lice including the wooly aphis. Other insects contribute smaller proportions to the Downy's diet; those worth mentioning are white ants, flies, wasps, and grasshoppers. The eggs of grasshoppers are obtained more frequently than those insects themselves and the same is true of those of roaches. Various invertebrates popularly classed as insects but which really are outside of the six-legged alliance are picked up now and then; among them we may cite ticks, spiders, daddy-long-legs, pseudoscorpions, sowbugs, centipeds, and millipeds. Snails are occasionally eaten, and rarely very small reptiles and amphibians. Only a little more than one-twentieth of the food of the Downy Woodpecker is of vegetable origin and most of that consists of wild fruit. Those of sumacs, especially the poisonous ones, and of bayberry are favorites. Corn, mostly waste, and mast are the other notable items

of vegetable food. The Downy Woodpecker is as useful as he is friendly, and it is not likely that man's hand will be, or ever need be, raised against him.

YELLOW-BELLIED SAPSUCKER. *Sphyrapicus varius* Linnaeus.

Resident

This is the true Sapsucker (Fig. 8), punishment for whose misdeeds has often been visited upon the smaller spotted woodpeckers and especially upon the common and familiar Downy. However, the Sapsucker should be easily recognizable as it is the only New York woodpecker having a broad white marking on the upper part of the wing, appearing as up and down the side when the bird is at rest. The Sapsucker breeds chiefly in the Catskills and Adirondacks, winters sparingly in the southeastern district, but is found commonly in migration in all parts of the State. The usual season of occurrence is from April to October.

The Yellow-bellied Sapsucker eats fewer insects than the Downy and Hairy Woodpeckers, about 50 per cent of its diet as contrasted with more than 75 per cent by those species. Moreover, it consumes almost none of the special enemies of trees which the two smaller species attack so freely. Ants are the Sapsucker's favorite insect food, constituting more than a third of the total diet. Other hymenoptera, various beetles, and a variety of other insects make up the balance of the insect food. The only forest pests identified in 313 stomachs examined were: the oak weevil (*Pandelestus hilaris*), the plum scale (*Eulecanium cerasifer*), and eggs of the moth of one of the tent caterpillars.

The vegetable food of the Sapsucker is chiefly wild fruits (28 per cent), and cambium or the inner bark (growing layer) of trees (16 per cent). The sap taken by the birds no doubt exceeds in bulk the other elements of the diet, but of course it does not remain in the stomachs and consequently does not figure in the percentages of food items. The Sapsucker is a tippler, no doubt of that, and spends much of its time making the rounds of the holes it has bored in various trees. Like other tipplers it sometimes becomes tipsy, as the sap in its favorite pits becomes fermented. (Cf. Adams, '23a, pp. 513-516.)

Professor Eaton observes in his Birds of New York that the Sapsucker "bores numerous rows of holes through the bark of our sap trees, sometimes entirely riddling the trunk and causing the sap to flow in such abundance as to destroy the vigor of the tree. One frequently finds mountain ash trees, pines, black spruces, ironwoods, and birches so weakened by the boring of this species that they never

recover" ('14, p. 150). Dr. Chas. C. Adams has recorded the killing of aspens, birches, and maples also by these woodpeckers in New York ('23a, pp. 496-509).

Sapsucker pecking disfigures ornamental trees, giving rise to pitch streams, gummy excrescences, and deformities of the trunks. Small fruit trees, especially apple, are often killed, and whole young orchards have been destroyed by these birds. Sapsuckers are known to attack no fewer than 258 kinds of trees, shrubs, and vines in the United States, 63 of which are often seriously injured and 32 have been killed.

However, the killing of trees outright is by no means the greatest damage done by Sapsuckers. Indeed, in the aggregate these birds inflict much greater financial loss by producing defects in the wood of the far larger number of trees which they work upon but do not kill. Blemishes reducing the value appear in the lumber from such trees and in the various articles into which it is manufactured. These defects consist of distortion of the grain, formation of knotty growths and cavities in the wood, extensive staining, fat streaks, resin deposits, and other blemishes. All of these result from injuries to the cambium, their variety being due to differences in the healing.

It has been found that Sapsucker work unfits for use such important ornamental woods as black walnut, white oak, yellow poplar, chestnut, cherry, and hard maple; that it seriously blemishes woods prized for particular qualities, such as ash, basswood, red cedar, buckeye, dogwood, and hickory; and that it sometimes destroys the value of wood even for heavy construction. Defects due to Sapsucker injury have been found in the wood of 174 species of trees. In 90 of these they at times become so serious as to spoil the appearance or workability of the wood, and in 22 species they render the wood useless, except for coarse construction or for fuel.

Hickory trees are favorites of the Sapsucker, and defects in the wood, though severe, may be used to illustrate the general character of this form of damage and also the resulting loss (see Figs. 9, 10). Blemishes in hickory due to Sapsucker work consist of open black checks, varying in size up to two by four inches, sometimes walled with rotten wood or partly filled with spongy growth, and frequently connected with gnarly fissures, up to two inches in length, which usually extend toward the bark. These are surrounded by brown or black stains, called iron streaks, which penetrate more or less wood adjoining the wound and follow the grain sometimes for many feet, making conditions favorable for checking and rendering the wood harder to work. The abundance and extensiveness of stains and

gnarly growth in hickory spoil the wood for many of its most important uses. A large proportion of hickory trees are attacked by Sapsuckers, and it is estimated that about 10 per cent of the merchantable material is left in the woods on account of bird pecks.

It so happens that hickory is one of the woods of which the merchantable stand is rapidly approaching exhaustion. While on this account the specific charge of seriously damaging hickory will not lie so heavily against Sapsuckers, the general injurious relation of these birds to valuable forest trees is in no way mitigated. Indeed when the practice of growing forests as a crop becomes more general, as it must, it is probable that Sapsuckers will prove to be even greater pests than here indicated, and that measures for controlling the numbers of these birds will become a necessary part of forest management.

RED-HEADED WOODPECKER. *Melanerpes erythrocephalus* Linnaeus.

Resident

The Red-headed woodpecker (Fig. 11) is less common in New York than formerly, due no doubt to the decrease in number of dead trees and branches in which it excavates its nest. However, it is still fairly represented throughout the Alleghenian faunal area except in the southeastern part of the State. This woodpecker, probably even more than the Sapsucker, is responsible for the bad name given its tribe. Depredations upon small fruits and grain, and upon the eggs and young of other birds are the counts against the Red-headed, and all are true.

Of these traits only the attacks upon the nests of other birds are of interest in connection with the status of the Red-head as a woodlot bird. Such forays, while not really numerous, occur too often for the good of woodlots, as the smaller species destroyed, in every case, are more beneficial in relation to trees than is the Red-head.

Wild fruits constitute about a sixth of the total food of this species, and mast about one-fourth. In feeding upon these the Red-head undoubtedly scatters the seeds of various trees and thus aids in reforestation. The seeds of service berry, the various wild cherries, dogwood and sour gum are among those distributed. Acorns and beechnuts are the favorite kinds of mast consumed and it has been repeatedly observed that a good crop of beechnuts is the determining factor as to whether these woodpeckers will spend the winter in New York State. Dr. C. Hart Merriam states that in Lewis county the birds subsist almost entirely upon beechnuts during the fall and winter, even picking the green nuts while the trees are still covered

with leaves. "Gray squirrels, redheaded woodpeckers, and beech-nuts were numerous" he says, "during the winters of 1871-72, 1873-74, 1875-76, 1877-78, 1879-80, 1881-82, 1883-84, while during the alternate years the squirrels and nuts were scarce and the woodpeckers altogether absent." In early spring following a nut year, when the melting snow uncovers the ground, the birds feed on beechnuts that were buried during the winter. ('78, pp. 124, 125.)

The Red-head more than any other woodpecker, makes a practice of capturing insects upon the wing. It may frequently be observed sallying for this purpose from the dead top of a tree or from a telephone pole. The insects taken by the Red-head by this and other methods amount to a third of the total subsistence. Beetles are the largest item, comprising more than half of the total, and ants are next. When the list of insects eaten by the Red-head is scanned for special foes of trees but few are found. Leaf chafers, a few click beetles and long-horns, leaf beetles, and adults of the flat-headed borers, sapwood borer, and nut weevils are the tree-feeding beetles consumed, while cicadas and scale insects represent the group of bugs.

In moderate numbers the Red-headed Woodpecker may not exhibit its objectionable traits to an extent demanding control, and may then be regarded as somewhat more beneficial than injurious. Where, because of increase in numbers or for other reason depredations begin, it would seem that protective measures should be promptly inaugurated.

FLICKER. *Colaptes auratus* Linnaeus.

Resident

The Flicker, also known as High-hole and Yellow-hammer, and by numerous other names, is common and universally distributed in New York. "He is much more versatile in his propensities," says Professor Eaton, "than the other woodpeckers and is frequently seen far from groves and orchards, on the open field or lawn, and along the fences and telegraph poles. He is at home in the midst of our villages and city parks as well as in the farm lands and wildernesses. He perches on the twigs of trees more commonly than any of the other woodpeckers, and digs in the ground for grubs and worms, and tears open the ant hills in search of his favorite food." ('14, p. 160.)

Practically half of the entire food of the Yellow-hammer is ants and these insects have been found in three-fourths of all the stomachs of Flickers that have been examined. More than 5000 small ants

were counted from the full crop and stomach of a single bird, and more than 3000 were found in each of two other birds. Ants in general are a nuisance and as guardians of plant lice are really responsible for much of the damage done by those pests. All woodpeckers feed freely upon ants and are to be commended for it.

A variety of other insects are eaten in small quantities by the Flicker; click beetles, leaf chafers, pine weevils, cicadas, and white ants are among the tree pests eaten; the notorious chinch bug also is preyed upon. The Yellow-hammer has been observed to do good work also in digging out such tree pests as the peach borer, round-headed apple borer, and codling moth, and to feed on tent caterpillars.

Two-fifths of the subsistence of the High-holder consists of vegetable matter, and it is chiefly small fruits, with a little mast and grain. In the fall the wild black cherry is a favorite article of food and bearing trees of this species are a favorite resort of the birds. Formerly Flickers were shot as game and most of them were obtained in wild cherry trees. Now the bird is wholly and deservedly protected.

WHIP-POOR-WILL. *Antrastomus vociferus* Wilson.

Summer Resident

This bird prefers deep deciduous woods, and it occurs in these and other wild situations throughout the State. It is a summer resident only and the entire season of its occurrence is from the last of April to the middle of September. It is well known to all by its call, but to few by its appearance. It remains closely concealed by day and is most active early in the evening.

It is one of the most important foes of nocturnal insects and has so large a gape that it can swallow almost any of them. The favorite food of the bird is moths and often the entire meal is made of them. Forty or more have been found in a single stomach. When we remember that many of the moths eaten by the Whip-poor-will are females containing large numbers of eggs it become evident that the tribe has an important enemy in this bird. Moths are the parents of caterpillars and undoubtedly many of those eaten belong to species that are serious woodland pests.

After moths, large beetles of the leaf-chaffer family are staple food for the Whip-poor-will. The adults of white grubs (*Phyllophaga*) are captured with especial frequency, and remains of thirteen of them have been found in a single stomach. A variety of



Fig. 6. Hairy Woodpecker (left) ; Downy Woodpecker (right)



Fig. 7. Holes made by Woodpeckers in removing borers from trees.

other large beetles is taken including click beetles (the adults of wireworms), long-horned wood borers, dung beetles, sexton beetles, and nut weevils. Occasionally some of the large green grasshoppers of woodlands are eaten.

Mr. E. H. Forbush, State Ornithologist of Massachusetts, related to the writer the experience of having a Whip-poor-will come for several nights in succession to the head net of his tent and pick off all the mosquitoes.

The Whip-poor-will is almost exclusively a beneficial bird and should be protected in every way.

RUBY-THROATED HUMMINGBIRD. *Archilochus colubris* Linnaeus.
Summer Resident

The Hummingbird breeds in all parts of New York State and is present from May to September. Everyone has seen it probing flowers and the popular belief is that the bird subsists upon their nectar. Hummingbirds recently killed have been observed to drip nectar from their throats. The birds are greedy for sweets put out for them, and captive specimens have been known to live for some time on a diet of syrup or honey alone. However, these little sprites undoubtedly depend for most of their nourishment upon small insects and spiders. Most of the latter eaten are young as these only are small enough for the Hummer to devour. The insects eaten are chiefly small hymenoptera (including ants), leaf hoppers, and plant lice. The Hummer deserves some credit for feeding upon these last named items, but not for eating the small hymenoptera and spiders, most of which are beneficial. One Hummingbird's stomach contained 42 black flies (*Simulium*), and if such meals are taken to any extent the bird will be gladly credited for it. In relation to woodlots the Hummingbird probably is not of much importance one way or the other except perhaps as a pollen distributor. Hummers befriend other birds by driving away marauding crows and hawks.

CRESTED FLYCATCHER. *Myiarchus crinitus* Linnaeus.
Summer Resident

The Great Crested Flycatcher (Fig. 12) comes to New York in late April and stays until the end of September. It lives in groves and open forests in all parts of the State except the deep Adirondack and Catskill forests. More than nine-tenths of the food of this bird consists of insects and spiders. The vegetable part of the diet

consists of a variety of wild fruits, none of them taken to any great extent. The largest item of animal food consists of caterpillars and moths. More than a fifth of the total subsistence is derived from this source, a good service to the forest, as practically all caterpillars are injurious and the chief function of the moths, their parents, it to keep up the supply of these tree strippers. The green oak caterpillar (*Nadata gibbosa*) and the green-striped maple worm (*Anisota rubicunda*) are pests specifically identified from stomachs of the Crested Flycatcher. Besides the caterpillars and moths (Lepidoptera) four other of the larger orders of insects contribute about equally to the subsistence of the Great-crest and make up practically all of the balance of the food. Most of the species of one of these groups, the Hymenoptera, are beneficial, but the ants and sawfly larvae, at least, among them are undesirables in the woodlot. The Orthoptera eaten may all be counted to the credit of the Great-crest, and some of them of the katydid group feed exclusively on trees. The bugs or Hemiptera include cicadas, tree hoppers, and leaf hoppers also that feed upon trees. Among destructive forest beetles preyed upon by the Great-crest are click beetles, adults of flat-headed wood borers, leaf chafers, Junebugs, the goldsmith beetle, long-horned wood borers (including pine sawyers — *Monochamus*, — *Typocerus zebratus* which bores in white oak, and *Liopus variegatus* which feeds in a number of trees, among them being maple, locust, and box elder), leaf beetles (including the locust leaf miner), and weevils, including the plum curculio and nut weevils. Two-winged flies, dragon flies, and a few others complete the list of insects preyed upon. Numerous spiders also are eaten. Although some beneficial creatures are consumed, on the whole the food habits of the Crested Flycatcher are to be commended. This species will utilize nest boxes and thus can be induced to nest in woodlands where there are no large cavities in trees such as are its natural choice for a home.

OLIVE-SIDED FLYCATCHER. *Nuttallornis borealis* Swainson.

Summer Resident

In New York this flycatcher is practically confined as a breeder to the Catskill and Adirondack regions. Elsewhere it is seen only as a rather scarce migrant, chiefly in May and September. It is an inhabitant of burns, slashings, and swamps rather than of the denser forest. The food is almost exclusively animal, and hymenoptera (bees, wasps, and ants) compose over four-fifths of it. Honeybees are a very prominent item in the diet but their destruction must not be

given great weight in the case of this bird of the wilderness, because there can be no doubt that most of the bees eaten come from the wild colonies that are so frequent in woodlands, and not from hives on bee farms. At an apiary, however, the Olive-sided Flycatcher would be a menace. Beetles, grasshoppers, bugs, and moths, in nearly equal proportions make up nearly all of the balance of the food. Insects injurious to woodlands which were identified in the diet of the Olive-side were carpenter ants, click beetles, adults of both flat-headed and round-headed wood borers, leaf chafers, nut weevils, bark beetles, and cicadas. One of the flat-headed borers (*Melanophila fulvoguttata*) is destructive to hemlock and spruce, while another (*Asemum moestum*) attacks pine, spruce and other trees.

WOOD PEWEE. *Myiochanes virens* Linnaeus.

Summer Resident

This well-known flycatcher, a common woodland species, breeds in every county of New York State. Its season of occurrence is from May to September. The food of the Wood Pewee is almost exclusively derived from the animal kingdom, only a little more than one per cent of it being vegetable. This consists almost entirely of wild fruits such as those of elder, blackberry, dogwood and pokeberry. Spiders and millipeds are eaten regularly but in small quantities, composing only a little over two per cent of the whole subsistence. Besides the items mentioned the remainder of the food of the Wood Pewee consists entirely of insects. The more important groups are flies (about 30 per cent of the total food), hymenoptera (28 per cent), beetles (14 per cent), lepidoptera (12 per cent), bugs (6 per cent), and grasshoppers (3 per cent). Among forest pests consumed by the Wood Pewee are carpenter ants, tussock and gipsy moths, and cankerworms, click beetles, leaf chafers, adults of both flat-headed and round-headed wood borers, leaf beetles, nut weevils, bark beetles, and tree hoppers. Among the specifically identified insects that have been recorded as injurious to woodlands in New York State, and are eaten by the Wood Pewee, are: a flat-headed wood borer (*Chrysobothris pusilla*) injurious to hard pine, the two-lined borer (*Agilus bilineatus*), which is known to kill oaks and chestnuts, *Goes debilis* which feeds on hickories and oaks, locust leaf miner (*Odontota dorsalis*), mottled willow borer (*Cryporhynchus lapathi*), a pest to poplars and a scourge in willow plantations, a bark beetle (*Tomicus calligraphus*) which seriously

injures pines, the pine bark beetle (*Tomicus pini*), known to kill pines, and the hickory bark borer (*Scolytus quadrispinosus*) which has been known to kill 90 per cent or even more of the hickories in various areas in the State. The Wood Pewee consumes also various useful insects, as parasitic wasps, ladybird beetles, and certain others, but on the whole is a very good friend of the woodlot.

ACADIAN FLYCATCHER. *Empidonax virescens* Vieillot.

Summer Resident

This little flycatcher seems to prefer the drier upland woods of some density. It nests in the warmer parts of New York State, chiefly the lower Hudson Valley, and is present in the State from May to September. Wild fruits compose about 3 per cent of the Acadian Flycatcher's food, spiders, daddy-long-legs, and millipeds a like proportion, while insects contribute the remainder. Hymenoptera form 40 per cent of the whole diet, lepidoptera nearly 20 per cent, beetles about 14 per cent, and flies, bugs, grasshoppers, and crickets the balance. Ants are freely taken, the destructive carpenter ants among them; click beetles, flat-headed and round-headed borers, leaf chafers, the rose beetle (*Macrodactylus subspinosus*), the locust leaf miner (*Odontota dorsalis*), other leaf beetles, nut weevils, bark beetles, and tree hoppers are forest parasites consumed. More beneficial than injurious the Acadian or Green-crested Flycatcher is one of the various friends of the forest, which, though usually overlooked, continue steadily working to our good.

LEAST FLYCATCHER. *Empidonax minimus* Baird.

Summer Resident

This is the most common of the four species of small flycatchers that inhabit New York State. It breeds in orchards, groves, and open forests throughout the State, the season of occurrence as with the other species running from May to September. Like the other members of its genus the Least Flycatcher is satisfied with a very small proportion (slightly over 2 per cent) of vegetable food. That consists chiefly of such wild fruits as blackberry, dogwood, elderberry, and pokeberry. Spiders also form about 2 per cent of the food, and the remainder is insects. As usual among flycatchers, hymenoptera are the largest single component of the diet, forming over 40 per cent; beetles compose over 20 per cent; flies and bugs something more than 10 per cent each; and moths, caterpillars, and grasshoppers the balance. Insects injurious to woodlands which are eaten by this flycatcher include carpenter ants, gipsy moths, click

beetles, leaf beetles, nut weevils, tree hoppers, leaf hoppers, and leaf bugs. The Least Flycatcher destroys some useful insects, but in general is as useful as it is a neat and attractive denizen of the woodland.

BLUE JAY. *Cyanocitta cristata* Linnaeus.

Resident

The bright colors and loud calls of the Blue Jay (Fig. 13) attract the attention of all observers so that the species is as generally known as any in the State. Jays occur in every county at all seasons, nevertheless they migrate more or less, instances of which are observed from time to time especially in spring. The Blue Jay has close relations with the forest in a number of ways and would demand, if it did not otherwise receive, careful consideration in these respects. Fully half of its entire food is composed of woodland fruits and nuts, and the question arises at once as to whether or not this is to the detriment of the forest. A very large share of the vegetable food of the Blue Jay is mast, namely acorns, beech nuts, chestnuts, chinquapins, and hazel nuts. Acorns lead all the others by far in importance to the Jay. Consumption of quantities of these nuts and seeds upon which forest reproduction depends, considered alone, would have to be reckoned against the bird, but the Jay has so strongly developed the habit of storing nuts far in excess of the numbers it actually devours, that the bird must be ranked as one of the most important of nature's tree planting agencies. In obtaining nuts from trees it scatters the crop more or less, and often nuts are dropped by flying Jays at a considerable distance from the parent tree. All in all, except when there is a very short crop Blue Jays help the trees enough by distributing their seeds, to pay for the quantity they consume, and since trees do not depend for reproduction on one crop of nuts, this probably is also a good long-time view of the situation to take. Certainly no harm is done by the Jay in getting less than a tenth of its total diet from wild fruits, since seeds of most of the fruits eaten are rapidly passed through the body of the bird, emerging in better condition for germination than before, and being dropped in most cases at some distance from their source. The Jay's favorite wild fruits are mulberries, cherries, sumac berries, blackberries, blueberries, and grapes.

Before pointing out the good deeds of the Blue Jay attention should be given to another serious fault, namely, destruction of the eggs and young of other birds. Field observation indicates that far too much of this occurs, especially in certain localities, while the

results of stomach examination tend to minimize the showing of damage. The discrepancy between the results of these two lines of investigation probably means that nest robbing is more of an individual or local, rather than general trait. The best remedy in such cases is to eliminate the offending individuals, not to wage warfare on the race.

Because of its destruction of insects the Blue Jay has a favorable side to its food habits about which we can speak with as much enthusiasm as in the case of any other insectivorous bird. The fourth of its diet which it obtains from the animal kingdom is largely made up of insects. Beetles, orthoptera, lepidoptera and hymenoptera, in the order named, are the important sources of this part of the food of this species. Items of food of especial interest in relation to woodlots are, for the hymenoptera, carpenter ants, sawfly larvae, and *Tremex* borers. Among the orthoptera, katydids, walking-sticks and other forms that feed on trees are eaten. The lepidoptera include moths and butterflies; and their immature stages, the eggs and caterpillars, are preferred by most birds. The Blue Jay is well known to tear open the winter nests of the browntail moth and devour their contents, and this bird is a special foe of the eggs of tent caterpillars. No fewer than 1047 of these eggs have been counted in the contents of a single stomach. The Blue Jay has been known to extirpate local infestations of tent caterpillars. Other caterpillar pests devoured include the green striped maple worm (*Anisota rubicunda*), the striped hickory caterpillar (*Datana angusii*), and the yellow-necked apple worm (*Datana ministra*). The latter is also a general feeder on deciduous forest trees. Among beetles, pests of the forests identified in the food of the Blue Jay were: the larger flat-headed pine borer (*Chalcophora virginiensis*), the arbor-vitae borer (*Dicerca punctulata*), click beetles, leaf chafers, Junebugs, the goldsmith beetle (*Cotalpa lanigera*), the ribbed pine borer (*Rhagium lineatum*), the poplar borer (*Saperda calcarata*), the oak weevil (*Pandoltejus hilaris*), the sapwood borer (*Hylobius pales*), the New York weevil (*Ithycerus noveboracensis*), the oak weevil (*Eupsalis minuta*), and nut weevils. In another group of insects—the bugs—which do not compose so large a proportion of its diet the Jay finds some notable woodland pests to devour, such as the seventeen-year locust, tree hoppers, and scale insects.

It would appear that if nest robbing Blue Jays can be decreased in number or eliminated, the remaining Jay population, serving as efficient tree planters, and preying upon numerous insect foes of the forest, would be well worth protecting.



CROW. *Corvus brachyrhynchos* Brehm.

Resident

Everyone knows the Crow (Fig. 14). It is a bird of character, bold yet wary, doing conspicuous service to agriculture at some times, and what appears to the farmer as diabolical destruction at others. The crow breeds in every county in New York, but withdraws from the coldest parts of the State in winter, forming a number of large roosts in the warmer portions. The streams of crows converging on these roosts in late afternoon make a never-to-be-forgotten impression on the beholder. From 20 to 40 thousands of Crows have at times frequented a single New York roost. These numbers suggest to the observer an unlimited capacity for destruction on the part of the birds, but it must be remembered that there is little opportunity for the Crow to do damage at the time of year the large roosts are formed, namely winter. In summer the birds are scattered about in pairs or small flocks, and no local area has to support any such numbers of crows as congregate in the winter roosts.

While some statement may be expected in the present connection on the general relations of the crow to agriculture, it is not an integral part of the matter the writer is collating on the economic status of woodland birds. Hence he will quote the conclusion reached by E. R. Kalmbach in his study on "The Crow and Its Relation to Man," and then proceed to discuss the special relations of the Crow to woodlots. Mr. Kalmbach says:

"When feeding on injurious insects, crustaceans, rodents, and carrion, and when dispersing seeds of beneficial plants, the crow is working largely for the best interests of man; when destroying small reptiles, amphibians, wild birds, poultry, corn, and some other crops, when molesting livestock and distributing their diseases, and when spreading seeds of noxious plants, the bird is one of the farmer's enemies; when destroying spiders and mollusks, however, its work appears in the main to have a neutral effect. The misdeeds of which the crow has been convicted greatly outnumber its virtues, but these are not necessarily equal in importance. Much of its damage to crops and poultry can be prevented, while the bird's services in the control of insect pests can ill be spared. At the same time no policy can be recommended which would allow the crow to become so numerous that its shortcomings would be greatly accentuated. As the capabilities of the crow for both good and harm are great, it is believed that an extermination of the species would have ultimate consequences no less serious than an overabundance.

"Inasmuch as this investigation aimed at reaching general conclusions respecting the status of the crow, in order that our attitude toward the bird might be based on sound economic principles, it may be said that the laws relating to it, at present in force in most States, are altogether satisfactory. It is well that no protection be afforded the bird and that permission be granted for shooting it when it is actually found doing damage. Bounties can not be recommended, neither can a campaign of wholesale destruction where complete extermination is the object sought. However, a reasonable reduction of numbers is justifiable in areas where there is an overabundance of the birds. The attitude of the individual farmer toward the crow should be one of toleration when no serious losses are suffered, rather than one of uncompromising antagonism resulting in the unwarranted destruction of these birds which at times are most valuable aids to man." ('18, pp. 85-86).

Although the Crow is most often seen in open lands, it nests in woods and resorts there enough to have some opportunity to feed on woodland insects. Stomach examinations prove that it avails itself of these opportunities. Beetles form a large share of the Crow's insect food and among them are the following kinds recorded as destructive in woodlands: bronzy leaf miner (*Brachys acrosa*) which attacks elms, poplars, and oaks, the banded maple borer (*Buprestis fasciata*) which injures poplar also, the golden borer (*Buprestis striata*) the adults of which feed on the tender buds of pine and spruce, the larger flat-headed pine borer (*Chalcophora virginensis*), the common flat-headed borer (*Chrysobothris femorata*) which attacks various fruit trees as well as deciduous woodland trees, the flat-headed hickory borer (*Dicercus lurida*), leaf chafers, the goldsmith beetle (*Cotalpa lanigera*), junebugs, the rose beetle (*Macrodactylus subspinosus*), two round-headed hickory borers (*Clytanthus ruricola* and *Distenia undata*), the large sawyers (*Monochamus scutellatus* and *M. titillator*) which bore in dead and dying pine and spruce, leaf beetles, nut weevils, the sapwood borer (*Hylobius pales*), and the oak weevil (*Eupsalis minuta*).

The lepidoptera consumed by the Crow are mostly caterpillars fed to the young. Among them are some notable forest depredators, as the locust leaf folder (*Epargyreus tityrus*), the walnut sphinx (*Cressonia juglandis*), the promethea caterpillar (*Callosamia promethea*), a voracious feeder on the leaves of a variety of woodland trees, larvae of the buck moth (*Hemileuca maia*), which feed gregariously on oaks, those of the dagger moth (*Apatela oblongata*), devourers of the leaves of poplars, willows, and other trees, the



Drawn by Edmund J. Sawyer

PLATE 3. BIRDS OF THE FOREST FLOOR AND UNDERGROWTH

1, Hermit Thrush.

2, 3, Hooded Warbler
(male and female).

4, 5, Junco (male and female).

6, Chickadee.

7, 8, Black-throated Blue Warbler
(male and female).

9, Winter Wren.

10, Oven-bird.

11, Wood Thrush.

tussock caterpillar (*Hemerocampa leucostigma*) one of the worst pests of deciduous trees, the tent caterpillar (*Malacosoma americana*), and the canker worm (*Palaeacrita vernata*).

Among miscellaneous insects preyed upon by the Crow are a few others of interest in relation to woodlands. These are katydids, seventeen-year locusts and other cicadas, sawflies and their larvae, and ants including carpenter ants.

The Crow, like the Blue Jay, shows an undue fondness for the eggs and nestlings of other birds, but as in the case of the Jay the best way of improving the situation is by the elimination of individuals known to be seriously destructive in this way. Possibly in time a race of well-behaved Crows would result from such a selective process.

Crows also are distributors of seeds, and while not caching them to the extent that the Blue Jay does, plant them in a more wholesale manner by regurgitating pellets containing among other indigestibles the pits of fruits eaten. At the winter roosts such numbers of these pellets may accumulate as to cover the ground. That some of these seeds germinate can be verified at any Crow roost that has been occupied a few years. At the celebrated Woodridge Roost, in the District of Columbia, several years ago the writer found young plants of flowering dogwood, sour gum, highbush cranberry (a cultivated plant here), greenbrier, wild grape, poison ivy, and poison sumac. On a single square yard were counted 51 seedlings of poison ivy. The planting of poisonous sumacs must be reckoned against the Crow, yet as the objection to these plants is merely that they cause inconvenience, it is not important enough to counterbalance the credit due the Crow for the distribution of seeds of valuable trees as the red cedar, hackberry, wild cherry, holly, dogwood, and sour gum.

Viewed from the standpoint of woodland welfare alone, the Crow, except for his nest-robbing proclivities, is a useful species.

COWBIRD. *Molothrus ater* Boddaert.

Summer Resident

The Cowbird is seen more frequently in pastures and other open lands than in woodland and would not come into consideration as a bird affecting woodlots were it not for the fact that its eggs are laid in the nests of practically all kinds of small forest birds, resulting in every case in loss of a brood of the bird parasitized. Numerous observations indicate that only one young Cowbird is reared in each violated nest, others of its own kind that may be hatched, and

nestlings of the real owner of the nest being starved and crowded out. In New York the Cowbird infests all parts of the State except the higher mountain regions. It lays its eggs in the nests of 35 or more different kinds of birds, and parasitizes with especial frequency the nests of such common woodland species as the Song Sparrow, Chewink, Indigo-bird, Red-eyed Vireo, Chestnut-sided Warbler, and Redstart.

The Cowbird's food habits are at least moderately praiseworthy. It subsists on weed seeds (60 per cent of the diet), grain, chiefly waste (16.5 per cent), other vegetable food (1.2 per cent), grasshoppers (11 per cent), and other insects, spiders, etc. (11.3 per cent). Evidently Cowbirds do not feed much in woodlands, hence cannot have much effect on forest insect pests. They pick up a few of these, however, representing several groups of insects, as the click beetles, leaf chafers, junebugs, cicadas, tree hoppers, lace bugs, ants, walking-sticks, and sawflies.

To determine the Cowbird's economic worth we must compare the potentialities for good of one Cowbird as nestling and adult with that of an average brood of three or four of one of the species it parasitizes. As a nestling the Cowbird being larger than the young of most of its foster parents and receiving all the food both parents can gather, no doubt consumes more insects than would a single one of the usurped brood, but certainly not more than all of them combined. As an adult the Cowbird consumes fewer insects than even the smaller species among its victims as it takes a lower proportion of insects than the warblers, vireos, and the like which it so commonly parasitizes; certainly one adult Cowbird has not the insect-destroying capacity of 3 or 4 adults of more highly insectivorous birds.

When we consider the matter from the woodland point of view alone the Cowbird certainly must be condemned. Its food habits are of little benefit to the forest, and as each Cowbird represents a sacrifice of three or four more useful birds, the conclusion is inevitable that if the species could be eliminated the forest would be the gainer.

BALTIMORE ORIOLE. *Icterus galbula* Linnaeus.

Summer Resident

This Oriole (Fig. 15), one of our most gorgeously colored birds, retains among book students of birds the name originally given to it because the male wears the colors (orange and black) of Lord Baltimore. It is more frequently called Hangnest, Hangbird, Firebird, or Golden Robin by those who have not studied books on birds,

It lives in all parts of New York except the heavy forests of the Catskill and Adirondack regions and is most common in the warmer parts of the State. The Oriole comes in spring about the first of May and is one of the first birds to start on the fall migration which it does early in September.

Caterpillars are the most important single element of the Oriole's food, forming over a third of the total. The Baltimore is one of the birds that decidedly are not afraid of spiny or hairy caterpillars and it has a good record against such well-known pests as the fall webworm (*Hyphantria textor*), spiny elm caterpillar (*Euxaenestis antiopa*), tussock caterpillar (*Emeryocampa leucostigma*), forest tent caterpillar (*Malacosoma disstria*), and larvae of the gipsy moth (*Porthetria dispar*), and browntail moth (*Euproctis chrysorrhoea*). Orioles of this species have been known to destroy entirely local infestations of orchard tent caterpillars (*Malacosoma americana*).

Beetles, ants, parasitic wasps, bugs, grasshoppers, spiders, and snails are the principal additional components of the Hangnest's animal food. Among forms injurious to woodlands that are known to be preyed upon by the bird are tree hoppers, lace bugs, scale insects, plant lice, leaf chafers, junebugs, nut weevils, adults of flat-headed and round-headed wood borers, leaf beetles including the locust leaf miner, click beetles, oak weevil (*Eupsalis minuta*), and sawfly larvae.

The wild fruits eaten by the Baltimore Oriole are mostly june berries, mulberries, and blackberries. A few vegetable galls also are consumed.

The Oriole does some damage to cultivated peas and small fruits, but has such praiseworthy food habits in general that it certainly is the best policy to take special measures to prevent access to the peas and fruits, rather than to get legal permission to destroy the birds.

EVENING GROSBEEK. *Hesperiphona vespertina* Cooper.

Winter Visitor

The Evening Grosbeak (Fig. 16) does not come to New York every winter, but when it does visit the State, it is usually in large numbers. The birds are usually seen feeding on fruits of mountain ash and sumac, or the seeds of box elder. Examination of nearly ninety stomachs of Evening Grosbeaks collected in winter revealed no animal food at all. The seeds of maple, box elder, and ash made up almost forty per cent of the contents of these stomachs; seeds of various wild fruits as cherry, dogwood, mountain ash, and

snowberry, an equal amount; and those of coniferous trees, mainly juniper, most of the remainder. In summer about a fifth of this grosbeak's food is of animal origin, but the details are of no interest in relation to New York woodlots, as the bird never summers in the State. The Evening Grosbeak has no pronounced tendencies either for good or harm, but may well be protected for its interesting habits and beauty.

PINE GROSBEAK. *Pinicola enucleator leucura* Müller.

Winter Visitant

Every winter sees the Pine Grosbeak in New York State, though some years they are much more abundant than others. Eaton notes that, "The food of the Pine Grosbeak in this State includes the seeds of spruces, larches, hemlocks, and pines, berries of sumac, mountain ash, cedar, Crataegus or American hawthorn, and wild apple, also buds of apple, peach, and birch." ('14, p. 256.) Stomach examinations confirm the consumption of most of these food items and add other details. The winter food of the bird is almost exclusively vegetable, and the most important items found in a study of 365 stomachs were seeds of blackberries, and the flower buds of coniferous trees, especially pine. Together these substances made up nearly forty per cent of the total food. Snowberries, juniper berries, and seeds of conifers, maple, and ash are fairly important items, and a variety of wild fruits and mast compose the remainder of the subsistence. As in the case of the Evening Grosbeak, the more insectivorous habits of the species in summer are of no importance to New York woodlots. It is not believed that the feeding on forest seeds and buds by this bird is ever seriously detrimental, and the Pine Grosbeak along with its brightly colored confreres the Evening Grosbeak and the Crossbills, may well be protected for esthetic reasons.

PURPLE FINCH. *Carpodacus purpureus* Gmelin.

Resident

The Purple Finch, a beautiful creature and an enthusiastic and melodious singer, breeds in all sections of New York State. It is not common, however, in the warmer portions. The species has a definite migration, but as it includes southeastern New York in its winter home, some Purple Finches are present in the State at all times of the year.

No scientific investigation of the food habits of the Purple Finch in the East has so far been made, so it is necessary in this instance

to fall back on general observations. Eaton's account of the food of the species in New York is as follows: "The food of the Purple Finch consists in spring largely of the buds of trees. Unfortunately the buds of the peach, cherry, and apple trees are frequently selected. In this way he often does considerable harm to the peach and cherry orchard, but serious complaints have come from only a few localities in New York. Later in the season I have often found them feeding on green cherries, one-fourth grown, on the green berries of the fly honeysuckle, viburnum, and ironwoods, and in the fall on the ripened fruit of the red cedar, white ash, hemlock, and nearly any species of seed-bearing tree. They rarely feed upon the ground, but sometimes where seeds are plentiful, hopping about after the manner of sparrows. In the winter I have noticed that they seem to prefer the seeds of maples, ashes, and mountain ash. Late in June I have found their food mostly confined to the samaras or ripened fruit of the elm tree." ('14, pp. 264-265.) Other items of food mentioned by observers in New York and neighboring States are flowers of beech, maple, and pear; buds of larch, hornbeam, and birch; and seeds of flowering dogwood, ragweed, burdock, spruce, larch, beech, sycamore, tulip tree, thorn-apple, and flowering crab-apple.

Apparently the Purple Finch is almost entirely vegetarian; if harm results from its budding, the bird does little to offset it. From a woodland standpoint the species is potentially, but probably very seldom actually, injurious.

RED CROSSBILL. *Loxia curvirostra* Linnaeus.

Resident

The Common Crossbill breeds regularly in the Adirondack spruce forest, and is an irregular winter visitant in other parts of the State. Some winters they are present in large numbers and in others they may be entirely absent. Abundance of food has something to do with their wanderings and a stay on the part of the birds for any length of time may be taken as proof that there is an unusually good crop of seeds on one or more of the coniferous trees of the region. More than nine-tenths of the winter food of the Crossbill consists of such seeds, those of pines being most favored, but those of spruce, hemlock, and larch also being taken. In summer also coniferous seeds are staple diet, composing, however, at this season only about seven-tenths of the Crossbill's subsistence. More insects and wild fruits are eaten at this season, while in winter the extra items of food are chiefly weed seeds and mast. The bird also extracts the seeds from

apples hanging on trees in winter, eats some buds, and also takes sunflower seeds when opportunity occurs. Plant lice, weevils, spittle-insects, and caterpillars—all insects injurious to woodlands—are devoured, but in small quantity. Field observers have seen Crossbills feeding on spiny elm caterpillars, and the tent caterpillars also.

Since forest trees produce large crops of seeds year after year, reforestation is so amply provided for that ordinarily consumption of coniferous seeds by Crossbills does no actual harm. The birds only rarely damage any crop, and on the other hand seldom benefit us by destruction of injurious insects. As well as may be the species is neutral, economically, with tendencies which are likely to render its activities injurious under unusual conditions.

WHITE-WINGED CROSSBILL. *Loxia leucoptera* Gmelin.

Resident

This crossbill breeds in New York only in the Adirondack region; like the Red Crossbill it wanders erratically in search of food, but some of the birds, no doubt, are present in the State at all seasons, most numerous so, however, in the winter. More than nine-tenths of the food of this crossbill is vegetable, the bulk of it being seeds of coniferous trees, those of spruce and hemlock being most often found in the stomachs thus far examined. Buds, huckleberries, crowberries, and weed seeds are the other known items of vegetable food. The animal food of the White-winged Crossbill is composed chiefly of caterpillars, including cankerworms, and the birds have been observed feeding also on larvae of the pitch pine sawfly (*Diprion pinus-rigida*).

The economic status of this species may be said to be about the same as that of the Red Crossbill, and because of the lesser numbers of the species is of even less importance.

PINE SISKIN. *Spinus pinus* Wilson.

Resident

The Pine Siskin nests irregularly in the Catskills and Adirondacks and probably is present in some part of New York State every winter, though in widely varying numbers. The bird is commonly found in forests of hemlock, pine, and spruce, alder swamps, and open fields. The food of the Siskin is principally the seeds of coniferous trees, alder, birch, ragweed, and other weeds. About one-sixth of the total food is animal, consisting chiefly of caterpillars, plant lice, scale insects, and grasshoppers. No doubt the Siskin pays, in the destruction of these pests, for the forest seeds it consumes.



Fig. 8. Yellow-bellied Sapsucker.



Fig. 9. Characteristic Sapsucker work on hickory. The protruding girdles result from annual re-opening of old holes.

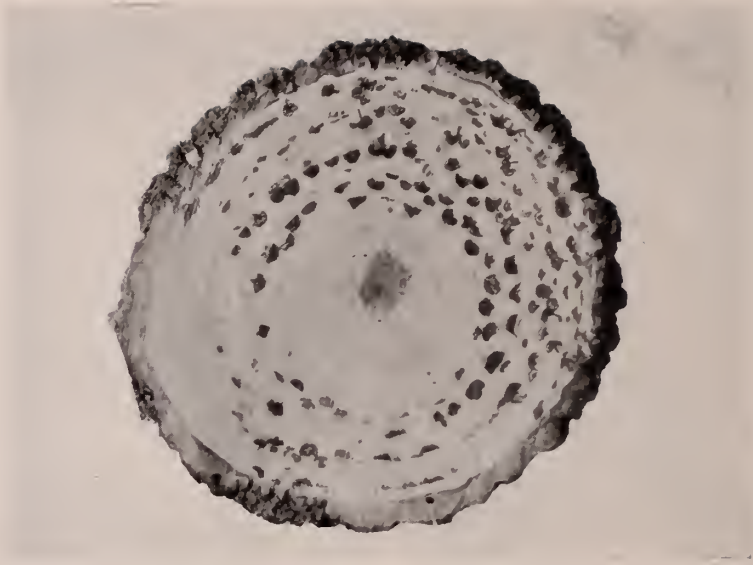


Fig. 10. Sapsucker work in hickory. A cross-section through one of the girdles shown in Fig. 9. These stains may run several feet up and down the grain.

WHITE-THROATED SPARROW. *Zonotrichia albicollis* Gmelin.

Resident

The White-throat is one of the commonest breeding birds of the north woods of New York, and occasionally has nested at scattered points elsewhere in the State. A few of the birds winter in the mildest portions of the State, but the bulk of the species is present only between early April and November. This sparrow has one of the sweetest songs of any of our native birds and its greeting to the wanderer in north woods in spring is one of the most appreciated of Nature's offerings. The opening of the fishing season comes when the White-throat is in full song, and anglers in some localities look upon the species which they call Trout-bird as peculiarly their own.

About one-fifth of the food of the White-throated Sparrow is derived from the animal kingdom and four-fifths from the vegetable. Weed seeds such as those of ragweed, smartweed, and grasses are very important elements of the vegetable food, but wild fruit composes a larger proportion of the subsistence than is usual among sparrows. The favorite kinds are strawberries, cherries, blackberries, elderberries, blueberries, and the fruit of the wild sarsaparilla. Numerous other kinds are eaten in smaller quantities. Some budding is done but rarely to an injurious extent.

Beetles, and ants, and other hymenoptera are the largest components of the animal food of the White-throat, with caterpillars, bugs, and flies ranking next. A few crickets, grasshoppers, millipeds, and snails also are eaten. Among insects injurious to forests this sparrow preys upon carpenter and other ants, gall wasps, caterpillars, leaf beetles, junebugs, weevils, including the sapwood borer (*Hylobius pales*), and sawflies. Agricultural pests which it is known to devour include the rose beetle, clover-root weevil, currant worm, and army worm.

The White-throat rarely does any harm, is constantly doing some good, and is a lovely singer and shy friend that should be protected.

JUNCO; SNOWBIRD. *Junco hyemalis* Linnaeus.

Resident

This slate-colored sparrow, with the White V in its tail, and white bill, is one of the most abundant birds of New York. It breeds commonly in the Catskill and Adirondack regions and other higher lands, and winters commonly throughout the State. In the breeding season about half of the Snowbird's food is composed of insects, but for the year as a whole only a little more than one-fifth. As is true of

most other sparrows the vegetable food is chiefly weed seeds. Those of smartweed, pigeon grass, crab grass, dock, lamb's quarters, and pigweed are most frequently taken. Some wild fruits are consumed, as blueberries, elderberries, blackberries, and fruits of sumac. Plant galls are taken rather freely. Among the insects eaten, beetles, grasshoppers, caterpillars, and ants bulk largest. Agricultural pests taken by the Snowbird include leaf hoppers, flea beetles, and clover-leaf, and clover-root weevils. Undesirable forest insects fed upon comprise plant lice, adults of round-headed and flat-headed wood borers, carpenter and other ants, caterpillars, leaf beetles, including the locust leaf miner, weevils, click beetles, bark beetles, and sawflies.

Rarely Snowbirds have been known to do damage by budding fruit trees, but for the most part their food habits are commendable, and we may well encourage their cheery presence.

SONG SPARROW. *Melospiza melodia* Wilson.

Resident

While scarcely a woodland bird, the Song Sparrow inhabits small clearings, edges of woodland, shrubbery along streams and fence rows, things which are part and parcel of most woodlots, and moreover is so common that probably there is scarcely a patch of woods in New York State that it does not inhabit. The bird breeds throughout the State, and winters in the milder portions generally, as well as in protected swamps and marshes elsewhere. The Song Sparrow is well named, for its cheery lay may be heard at all seasons, most frequently of course in spring; it is not only one of the most familiar but one of the most pleasant of bird voices.

About one-third of the Song Sparrow's food is made up of insects and other small animal forms, and two-thirds of seeds and other parts of plants. Weed seeds are the most important element of the vegetable food and those of grasses, including crab and foxtail grasses, smartweed, ragweed, pigweed, and lamb's-quarters are preferred. Wild fruits such as elderberries, blackberries, and blueberries also contribute materially to this bird's subsistence.

Besides insects the animal portion of the food includes spiders, snails, millipeds and centipeds. The insects eaten in the order of their importance are, first, beetles, then grasshoppers, caterpillars, ants and their allies, bugs, and mayflies, stone flies and the like. The Song Sparrow comes into contact with more of the agricultural pests than do most of the sparrows inhabiting woodland and it may be well to name those upon which it is known to feed. They include

grasshoppers, cutworms, the army worm, cankerworm, chinch bug, plum curculio, Japanese beetle, flea beetles, leaf hoppers, the green bug and other grain aphids, the clover-root weevil, and billbugs. Although it inhabits the borderlands of forests rather than the woods themselves the Song Sparrow does not fail to encounter and devour various insects that are destructive to trees. Among them we may mention leaf chafers, Junebugs, click beetles, adults of both round-headed and flat-headed wood borers, carpenter and other ants, plant bugs, caterpillars including those of the gypsy and browntail moths, spittle insects, leaf hoppers, weevils, leaf beetles, among them the locust leaf miner, and alder flea beetle (*Haltica bimarginata*), a species sometimes a pest to cultivated willows, scale insects, including the pernicious oyster scale (*Lepidosaphes ulmi*), tree hoppers, sawflies, and white ants or termites.

There are practically no records of Song Sparrows doing harm, and from the data here cited it is obvious that they do much good. May they continue to flourish and to sing sweetly throughout the land, and may they ever be carefully protected as they so thoroughly deserve.

FOX SPARROW. *Passerella iliaca* Merrem.

Transient

The Fox Sparrow occurs more or less in winter in the extreme southeastern part of the State, but as that is not a woodlot section, the bird is classed as a transient for the purposes of this paper. In migration, chiefly in April and October, this species is fairly common in most of New York. It is a big, handsome sparrow which keeps closely to undergrowth about the edges of woodland. About one-seventh of the food of the Fox Sparrow is composed of animal and six-sevenths of vegetable matter. The Fox Sparrow eats very little grain, but is fond of weeds seeds of which its favorites are ragweed and smartweed, and takes more wild fruit than most sparrows, such as blackberries, bearberries, red haws, red cedar berries, frost grapes, and pokeberries. The insects most frequently eaten are ants, beetles, caterpillars, and bugs; spiders and millipeds are taken rather freely, and snails, centipeds, and pseudoscorpions occasionally. Leaf chafers, leaf beetles, round-headed wood borers, caterpillars, weevils, and ants, are enemies of trees sampled by the Fox Sparrow. This bird thus does some good, and practically no harm, so should continue to enjoy full protection.

CHEWINK. *Pipilo erythrophthalmus* Linnaeus.

Summer Resident

The Chewink, Towhee, or Ground Robin sojourns in New York State from late April to late October. It breeds in all sections except the Adirondack and Catskill mountain regions, and in the extreme northern counties. Professor Eaton says of it: "The haunts of the Towhee are in hedgerows, thickets, brushy hillsides, and 'slashings.' It is a bird of the thicket more than any other member of the sparrow family. It feeds principally upon the ground, hopping about, scratching the leaves, and bustling around with considerable noise." ('14, pp. 323-324.)

The food of the Chewink consists of a great variety of items, the bird taking apparently almost everything unearthed in its rummaging of the forest floor. About three-tenths of the food is animal matter and seven-tenths vegetable. Of the latter portion seeds, mast, and wild fruits are the important items. The mast consists chiefly of acorns; the favorite seeds are those of ragweed, foxtail grass, smartweed, and dock; and the fruits that are most frequently taken are those of strawberry, huckleberry, blueberry, bayberry, and blackberry. The Towhee has very rarely been observed to feed on any agricultural product.

Beetles are eaten more frequently than any other insects and among them weevils are especially favored. Moths and caterpillars, bugs, and ants are other insect food items of importance. Besides insects numerous spiders and snails, smaller numbers of daddy-long-legs, millipeds, and sowbugs, and a very few small salamanders, lizards, and snakes are consumed. The insects eaten include various agricultural pests such as the potato beetle, plum curculio, strawberry crown girdler, flea beetles, cutworms, striped and spotted cucumber beetles, and the cornfield ant. Pests of trees which are known to be on the bill-of-fare of the Chewink embrace nut weevils, bark beetles, adults of round-headed and flat-headed wood borers, leaf beetles including the locust leaf miner, and the variable leaf beetle (*Typophorus canellus*) which injures mountain ash and butternut among other trees, leaf chafers, junebugs, the goldsmith beetle, the yellow case-bearer (*Chlamys plicata*) which feeds on the leaves of numerous deciduous trees, click beetles, scale insects, cicadas, tree hoppers, carpenter ants, sawflies, and tent caterpillars and a great variety of other caterpillars. The Chewink is an exemplary woodland citizen and should receive our best protection.

ROSE-BREASTED GROSBEAK. *Zamelodia ludoviciana* Linnaeus.

Summer Resident

The beautiful Rose-breasted Grosbeak (Fig. 17) nests in all but the coolest and warmest parts of New York State, and since these areas of climatic extremes are small, it is a very generally distributed species. It is in the State from early May to October. Its favorite haunts are "rich woodlands with a fair stand of undergrowth, and swamps and stream courses well grown with alder, swamp maple, and birches . . . it prefers a mixed woodland where there is a considerable admixture of hemlock, pine, or spruce . . . it also inhabits pure forests of white oak and red oak on upland slopes but the damper forest is certainly preferred." (Eaton, '14, p. 328.)

The food of the Rose-breast is derived in almost equal parts from the animal and vegetable kingdoms. Of the vegetable food wild fruits are the most important item, and they compose about a fifth of the total subsistence. The Grosbeak does not wait for them to ripen but devours in the green state those of elm, wild cherry, honeysuckle, black haw, and dogwood. Its favorites among ripe fruits include elderberries, mulberries, and juneberries. The Rose-breast has been observed to feed on the buds of various trees but rarely does any damage in this way. The same may be said with reference to the bird's occasional forays in grain. Weed seeds and plant galls complete the noteworthy items of vegetable food of the species.

As to the better half of the bird's food that is of animal origin, we find that about 36 per cent is composed of beetles, 3.82 per cent caterpillars, 6.43 per cent hymenoptera, and 2.38 per cent scale insects. The remaining 3.33 per cent of its diet is made up of grasshoppers, true bugs, spiders, and a few flies and snails. The Rose-breasted Grosbeak has a splendid record as a predator upon certain agricultural pests. It has repeatedly been observed to clear fields of the potato beetle, and it feeds also upon both the striped and spotted cucumber beetles, the strawberry rootworm, the plum curculio, the plum leaf beetle (*Nodonota tristis*), and the army worm. Its record against forest insects is still better. It preys upon adults of both flat-headed and round-headed wood borers, in the former group getting among others the larger pine borer (*Chalcophora virginiensis*), and a hickory borer (*Dicerca obscura*), and among the latter the painted hickory borer (*Cyllene pictus*) one of the commonest and most destructive pests of hickory, and one of the oak borers (*Phymatodes varius*). Leaf chafers, junebugs, goldsmith beetles, nut weevils, the sapwood borer (*Hylobius pales*), and the oak weevil

(*Eupsalis minuta*) are on the Rose-breast's dietary, as are also, the spotted willow leaf beetle (*Melasoma lapponica*), the willow leaf beetle (*Calligrapha bigsbyana*), and the locust leaf miner (*Odontota dorsalis*). It devours also both the spring (*Paleacrita vernata*) and fall (*Alsophila pometaria*) cankerworms, both orchard (*Malacosoma americana*) and forest (*M. disstria*) tent caterpillars, and feeds also upon the larvae of those notorious forest pests the gypsy, browntail, and tussock moths. The Rose-breasted Grosbeak is a decided enemy of scale insects, and species of them known to be special pests of plum, hickory, tulip tree, and oak have been identified from stomachs of this bird. Plant lice, tree hoppers, and sawflies are other depredators on trees that the Rose-breast is known to devour. In fact, from the forester's viewpoint, the Rose-breast appears to be as good as it is beautiful, and merits the very best of protection.

INDIGO BUNTING. *Passerina cyanea* Linnaeus.

Summer Resident

The Indigo-bird is a common summer resident in all but the higher mountainous portions of the State. It arrives in early May and departs in late October. It is fond of brushy hillsides and slashings, but belongs among the birds that inhabit at least the edges of woodlands.

No comprehensive study of the food of the Indigo Bunting has been made but the data we do have indicates the species is highly insectivorous during the summer months. Professor S. A. Forbes collected 18 specimens in an Illinois orchard infested by cankerworms and found that all but one of the birds had fed on the worms, which formed 59 per cent of the total food of the birds. He found in these stomachs, also, remains of other caterpillars, leaf chafers, weevils, click beetles, and bugs ('83, pp. 13, 24-25). From other sources of information we learn that the Indigo-bird feeds upon one of the locust borers (*Agilus egenus*), upon grasshoppers, cankerworms, plant lice, and cicadas. The bird feeds to some extent also upon grain, as oats, and upon buds, but seems rarely to do notable damage. It seems safe to conclude that the Indigo is a useful as well as a charming woodland denizen.

SCARLET TANAGER. *Piranga erythromelas* Vieillot.

Summer Resident

No one who has seen a male Scarlet Tanager will ever forget its appearance; this scarlet and black bird seems to glow like a gem in its somber haunts in the forest. The female is a plain greenish

yellow bird and she broods her eggs in every county in New York State. Scarlet Tanagers are in the State from mid-May to early October.

Groves and forests are the chosen home of the Tanager, so it is likely to be present in every woodlot in New York. One-eighth of the food of this species is derived from the plant, and seven-eighths from the animal world. Wild fruits are the chief vegetable food, those of juneberry, huckleberry, bayberry, sumac, blackberry, elderberry, and blueberry being most frequently taken.

In its choice of animal food the Scarlet Tanager must be criticized for preying more extensively upon the useful Hymenoptera than upon any other group of insects. We do not imagine that the bird makes a special search for these insects, but believe that it merely happens to encounter them frequently in the particular places where it habitually feeds. After Hymenoptera the important insect groups on the Tanager's bill-of-fare are beetles, lepidoptera, and bugs.

Among the beetles eaten are several injurious to woodlands, as the leaf chafers (including the goldsmith beetle and junebugs), adults of round-headed and flat-headed wood borers, click beetles, leaf beetles (including the cottonwood leaf beetle (*Melasma scripta*) a serious pest of willows and poplars), nut weevils, and billbugs. The bugs preyed upon by this species comprise some forest pests also, as cicadas, leaf hoppers, spittle insects, tree hoppers, jumping plant lice, and scale insects. The Tanager feeds rather freely upon the last-named group, a seriously destructive one.

Many caterpillars are eaten by this bird, among them, no doubt, various forms especially destructive to trees. It has been reported to feed on the common tent caterpillar and upon larvae of the gipsy moth. Mr. Forbush reports that "two Scarlet Tanagers were seen eating very small caterpillars of the gipsy moth for eighteen minutes, at the rate of thirty-five a minute. These birds spent much time in that way. If we assume that they ate caterpillars at this rate for only an hour each day, they must have consumed daily twenty-one hundred caterpillars, or fourteen thousand seven hundred in a week." ('07, p. 63.) It is a great enemy of moths also, especially the largest kinds as the Cecropia and Luna moths (Forbush, '07, p. 214).

Other insects taken are ordinary ants, white ants or termites, and grasshoppers; and also miscellaneous small animals, including daddy-long-legs, spiders, millipeds, and snails. While the Scarlet Tanager feeds on the useful parasitic wasps and their allies to a greater extent than would seem desirable, it does enough good so that judgment from an economic point of view must be rendered in its favor.

CEDAR-BIRD. *Bombycilla cedrorum* Vieillot.

Resident

The Cedar-bird, Cedar Waxwing, or Cherry Bird, a sleek, brownish, crested bird, occurs throughout New York State at all seasons. In winter, however, it appears only in flocks which wander erratically, dependent on food supply. The Cedar-bird gets five-sixths of its food from the vegetable kingdom and at times is destructive to flowers of fruit trees, and later to the ripening fruit especially of cherries. Sometimes local control measures are necessary to preserve the crop.

Destruction of cultivated fruit is an index to the natural feeding habits of the bird, wild fruits being decidedly favored. Those most frequently taken are juneberries, strawberries, cedar berries, and the various wild cherries. The only other vegetable food of importance in the diet of the Cedar-bird is flowers.

The animal food (one-sixth of the whole) comprises quite a variety of items, of which beetles probably are most important. Leaf beetles, including the locust leaf beetle (*Odontota dorsalis*), and weevils are forms detrimental to the forest. Carpenter ants, sawfly larvae, caterpillars, cicadas, and scale insects are other tree pests eaten. The other noteworthy items of animal food are crane-flies, spiders, mayflies, dragon flies, and stone flies.

The Cedar-bird in some places is called Cankerbird, on account of a marked fondness for cankerworms, and it has a great reputation also as a foe of the elm leaf beetle. In New England it has several times been observed to clean up local infestations of this pest. The species has been observed to clear orchards of the tent caterpillars and to feed also on larvae of the forest tent caterpillar, the willow sawfly, the basket-worm of cedar, and the spotted willow leaf beetle.

Except in the orchard of ripening cherries, the Cedarbird is a desirable visitor. Although ordinarily it may not be highly useful, at times evidently it attacks some pests in a wholesale way. Then, just as it is able to do much harm by feeding in flocks on buds or fruit, it is able to do much by massed attack on some destructive insect. Its record in this respect is excellent.

RED-EYED VIREO. *Vireosylva olivacea* Linnaeus.

Summer Resident

The Red-eyed Vireo (Fig. 18) is the most common woodland bird of the Eastern United States, and it is common and breeds throughout the State of New York. It is a summer resident only, arriving in early May and departing about the middle of October.



Fig. 11. Red-headed Woodpecker.



Fig. 12. Great-crested Flycatcher.

It is a tireless songster, endlessly repeating its simple refrain even during the middle of the day when most of the other birds are silent.

About six-sevenths of the total food of the Red-eye is composed of animal matter, almost exclusively insects, and one-seventh is vegetable. The latter is made up almost entirely of wild fruits which are eaten chiefly in the months from August to October. The favorite kinds are blackberries, elderberries, and fruits of spice-bush, dogwood, Virginia creeper, and sassafras.

A third of the total food of this vireo is composed of caterpillars and moths, mainly the former. Tent caterpillars, a beech caterpillar (*Fentonia marthesia*), the hackberry caterpillar (*Chorippe celtis*), and various oak caterpillars (*Acronycta afflicta*, *Apatcla*, *Notodonta*, and *Anisota*) are among the injurious forms devoured. Mr. Forbush reports the Red-eye to be one of the most effective enemies of the gipsy and browntail moths ('07, p. 205), and Dr. Tothill credits the species with destroying in various years, from 11.4 to 89.5 per cent of the broods of fall webworms in Nova Scotia ('22, pp. 5-26).

Beetles, hymenoptera, bugs, and flies rank next to lepidoptera in importance as food items of the Red-eye. The beetles include a considerable number of forms injurious to trees of which we may mention: a flat-headed oak borer (*Cinyra gracilipes*), a flat-headed spruce borer (*Melanophila drummondi*), the common flat-headed borer (*Chrysobothris femorata*), which attacks a variety of trees, a black locust borer (*Agrilus politus*), an elm leaf miner (*Brachys acrosa*), leaf chafers of several sorts, all injurious, a round-headed grape borer (*Phymatodes amoenus*), a round-headed elm borer (*Physocnemum brevilineum*), the oak pruner (*Elaphidion villosum*), an important insect pest, four hickory borers (*Clyanthus ruricola*, *Centrodora picta*, *Lepturges querci*, and *Hyperplatys maculatus*), a pine borer (*Eudercus pini*), a birch borer (*Gaurotes cyanipennis*), two oak borers (*Leptura nitens*, *L. vagans*), a maple borer (*Leptostylus aculiferus*), two elm borers (*Saperda latralis*, *S. tridendata*), the latter a very injurious species, a poplar borer (*Mecas inornata*), the birch leaf beetle (*Syncta ferruginea*), two oak leaf beetles (*Cryptocephalus guttulatus* and *C. mutabilis*), the pine leaf beetle (*Glyptoscelis pubescens*), the variable leaf beetle (*Typohorus cancellus*), an oak leaf beetle (*Xanthonia decemnotata*), three locust leaf beetles (*Colaspis brunnea*, *Nodonota puncticollis*, and *N. tristis*), the spotted willow leaf beetle (*Melasoma lapponica*), and the cottonwood leaf beetle (*Melasoma scripta*), a well-known pest, a hickory flea beetle (*Phyllotreta picta*), an elm flea beetle (*Haltica chaly-*

trca), the willow flea beetle (*Crepidodera helxines*), the locust leaf miner (*Odontota dorsalis*), the locust seed weevil (*Spermophagus robiniae*), the New York weevil (*Ithycerus noveboracensis*), an enemy of several trees but especially of beech, the oak weevils (*Pandetelejus hilaris* and *Aphrastus taeniatus*), the reddish elm weevil (*Magdalis arnicollis*), the nut weevils (*Balaninus*), the hickory bark beetle (*Scolytus quadrispinosus*), and the pine bark beetle (*Ips pini*).

Other insects, more or less prejudicial to the welfare of the forest which the Red-eyed Vireo includes in its bill-of-fare are the walking-sticks, cicadas, spittle insects, tree hoppers, leaf hoppers, scale insects, sawflies, and carpenter and other ants.

While we are reciting the good record of this bird we may as well add the names of a few agricultural pests: the striped and spotted cucumber beetles (*Diabrotica vittata*, and *D. 12-punctata*), the click beetles (adults of wireworms), the clover-root weevil (*Sitona hispidula*), the clover leaf weevil (*Hypera punctata*), and the plum curculio (*Conotrachelus nenuphar*).

The only harm done by the Red-eye is the destruction of certain useful parasitic and predatory insects, but in view of the splendid record of the bird in feeding on injurious forms, this may well be overlooked. We may be sure that in its industrious scanning of our woodland trees, the Red-eyed Vireo is ever on the alert to snap up the insects infesting them, by far the most of which are not there for the good of the trees.

PHILADELPHIA VIREO. *Vireosylva philadelphica* Cassin.

Transient

In most places the Philadelphia Vireo is regarded as a rare bird, but it is reported as fairly common in migration about Rochester and in the lower Hudson River Valley. This vireo is exclusively a transient in New York State, and passes through chiefly in the months of May and September. From examination of 75 stomachs, a rather large number for this species, it was learned that only about seven per cent of the food is vegetable. This consists of wild fruits taken during the fall and includes dogwood berries, bayberries, wild grapes, and rose hips. In the earlier part of the season, the Philadelphia Vireo appears to be almost exclusively insectivorous. The favorite items of food are caterpillars (with a few moths), 26 per cent, beetles, 25 per cent, ants and other hymenoptera, 14 per cent, flies, 12 per cent, and bugs, 10 per cent. Spiders, daddy-long-legs, and a few stone flies, also are eaten. A bird which eats so many caterpillars is certainly a friend of the forest, and this vireo further

demonstrates its virtues in this direction by feeding on round-headed and flat-headed wood borers, weevils, leaf beetles (including the willow leaf-beetle, *Crepidodera helvina*; a species, *Haltica chalybea*, that feeds on elm; another, *Nodonota tristis*, devouring leaves of locust; the variable leaf beetle, *Typhophorus cancellus*; and a species feeding on oak, *Xanthonia 10-notata*), leaf hoppers, tree hoppers, spittle insects, and scale insects. The Philadelphia Vireo seems fond also of sawfly larvae, all of which are destructive, and is known to devour the yellow-spotted willow slug (*Pteronidea ventralis*), one of the worst pests of basket willows, and that notorious devastator the larch sawfly (*Lygaconematus crichsonii*). Our little transient vireo friend is known to eat some useful insects, as lady beetles and parasitic wasps, but surely it more than makes up for them by feeding to the extent of half or more of its food on the various tree pests here listed.

YELLOW-THROATED VIREO. *Lanius flavifrons* Vieillot.

Summer Resident

This vireo is a summer resident in all but the highest mountainous sections of the State. It is most common during the migration season which brings it to New York in early May, and takes it back to the winter home in mid-September. The loud and characteristic song of this species is heard more often than the bird is seen, as it spends most of its time in dense foliage, often high in the trees.

The Yellow-throat leaves New York before the season during which the Red-eye takes most of its vegetable food, and although it follows the example of that species in turning to wild fruits in the fall, it feeds upon them a much shorter time. Consequently wild fruits do not bulk so large in its dietary, composing less than two per cent of the whole. The remainder of the food is composed of spiders, and insects, more than 95 per cent of the latter.

Two-fifths of the entire subsistence is composed of caterpillars and moths, an item greatly to the credit of a woodland bird. Mr. Forbush credits it with eating tent, gipsy, and tussock caterpillars ('07, p. 208). Nearly a fourth of the food is derived from the bug group and includes such injurious forms as cicadas, tree hoppers, leaf hoppers, plant lice, and scale insects. The latter creatures number in their ranks many of the worst tree pests. Several kinds of scales were specifically identified in the food of the Yellow-throat, as follows: hickory scale (*Eulecanium caryac*), dogwood scale (*Eulecanium corni*), oak scale (*Kermes kingii*), grape scale (*Pulvinaria vitis*), and tulip tree scale (*Toumeyella liriodendri*).

Beetles compose one-eighth of the sustenance of this beautiful vireo and include numerous kinds detrimental to the woodlot. Among them we may mention: the common flat-headed borer (*Chrysobothris femorata*), leaf chafers, a round-headed elm borer (*Physocnemum brevilineum*), the oak pruner (*Elaphidion villosum*), the birch leaf beetle (*Syncta ferruginea*), the pine leaf beetle (*Glyptoscelis pubescens*), the variable leaf beetle (*Typophorus canellus*), an oak leaf beetle (*Xanthonia decemnotata*), a locust leaf beetle (*Colaspis brunnea*), the oak weevil (*Pandeletejus hilaris*), and the nut weevils (*Balaninus*). Other forest insects consumed by the bird are sawflies, gall wasps, and the carpenter and other ants. Pests of agricultural, rather than forest interest, which the Yellow-throat feeds upon, include click beetles (adults of wireworms), the clover root weevil (*Sitona hispidula*), and the plum curculio (*Conotrachelus nenuphar*).

The Yellow-throated Vireo has an unusually low record in consumption of useful insects, and as it does so well against the injurious ones, we must give it high rank as a woodland friend.

BLUE-HEADED VIREO. *Lanivireo solitarius* Wilson.

Summer Resident

This species nests only in the higher and cooler parts of the State. It arrives in spring late in April and leaves in fall about the middle of October. Like all of our vireos except the White-eye, the Blue-head is a quiet, rather sedately moving bird, much given to careful inspection of the leaves, twigs, and limbs of its beloved trees.

The present species, like most of our other vireos does not merely inhabit the trees but does much to benefit them. For instance by making three-tenths of its food of caterpillars and their parents the moths, it helps to cut down the tide of these insatiable leaf destroyers, which, if unchecked, immediately demonstrate their ability as forest defoliators.

Another fifth of the bird's food is composed of true bugs of various kinds, including cicadas, spittle insects, tree hoppers, leaf hoppers, and scale insects. Among forms specifically identified in this bird's food are the Sycamore-ball bug (*Belonochilus numenius*), the hickory scale (*Eulecanium caryae*), and the birch scale (*Eulecanium pruinatum*).

One-eighth of the diet of the Blue-head is composed of beetles, a lower proportion than taken by the other vireos, yet it includes a number of insects that live at the expense of woodland trees. These

comprise various leaf chafers, a hickory borer (*Centrodera picta*), the dogwood borer (*Psenocerus supernotatus*), a maple borer (*Lep-tostylus aculiferus*), the birch leaf beetle (*Syncta ferruginea*), the yellow case-bearer (*Chlamys plicata*), a general feeder on deciduous trees, the pine leaf beetle (*Glyptoscelis pubescens*), an oak leaf beetle (*Xanthonia decemnotata*), two locust leaf beetles (*Colaspis brunnea* and *Nodonota tristis*), the willow flea beetle (*Crepidodera helxines*), the spruce weevil (*Scythropus elegans*), and the nut weevils (*Balaninus*).

Other pests, some of the farm, others of the forest, that are in the dietary of the Blue-head are click beetles, the plum curculio (*Conotrachelus nenuphar*), sawflies, gall wasps, and carpenter and other ants.

Less than a twentieth of the total subsistence of the Blue-headed Vireo is composed of vegetable matter, mostly wild fruits. No cultivated fruit is taken, and only a limited number of useful insects. Numerous forms injurious to trees are preyed upon, and the Blue-head like its relatives must be reckoned as a firm friend of the forest.

The Warblers: Family Mniotiltidae. No detailed studies of the food habits of most of the species of this family have been made, hence the treatment of the group in this paper must vary from that accorded other families of birds. The family of wood warblers as it is known, is a distinctively American group of birds of which twenty-eight species breed in New York State. The warblers are chiefly small birds, they exhibit a remarkable diversity of brightly, yet harmoniously colored plumages, and most of the species have highly characteristic, yet pleasing songs, some of them, indeed, being gloriously musical. Well are these little beauties named wood warblers, for not only do all of them frequent the woodland but they live in all parts of it, the Black and White Creeper for instance keeping ever to the trunks and larger limbs of trees; many of the species scan the smaller limbs, twigs, and leaves; the Redstart not only feeds in this latter fashion, but constantly snaps insects from the air; the Oven-bird patrols the forest floor; and the Yellow-breasted Chat reigns in brushy clearings.

In our lists (pp. 11, 13) of common breeding and transient species of warblers resorting to New York woodlots are 21 species of warblers, for only 5 of which can we give information in any detail about the food. However, these are representative species and we may be sure that their good record as destroyers of woodland pests is a reliable index to the economic status of the tribe as a whole.

Warblers are strictly woodland creatures, and glean their living from among the insects that live upon trees. Most of the latter are injurious to the trees, and the more of them that are done away with by the warblers and our other small bird friends, the better off we shall be.

BLACK AND WHITE WARBLER. *Mniotilta varia* Linnaeus.

Summer Resident

This bark-creeping warbler breeds in all parts of New York State, but more commonly in the higher and cooler portions. It is one of the earliest of its family to arrive in spring, reaching southeastern New York during the latter half of April; it departs from the State about the middle of October.

In its excursions over the trunks and larger limbs of trees the Black and White Creeper is certainly not looking for vegetable food, and only a trace of such matter has been found in the stomachs examined. The food is chiefly insects but considerable numbers of spiders and daddy-long-legs also are eaten. Beetles, caterpillars, and ants are the larger classes of insect food, but moths, flies, bugs, and a few hymenoptera also are eaten. Among forest enemies that have been found in stomachs of this species are round-headed wood borers, leaf beetles, flea beetles, weevils, bark beetles, leaf hoppers, and jumping plant lice. The hackberry caterpillar, the hackberry psyllid, an oak leaf beetle (*Xanthonia 10-notata*), and the willow flea beetle, are forms specifically identified. Observers have reported this warbler to feed also upon ordinary plant lice, and upon larvae of the gypsy moth.

MYRTLE WARBLER. *Dendroica coronata* Linnaeus.

Resident

The Myrtle Warbler breeds only in the spruce belt of the Adirondacks and Catskills but is one of the commonest of warblers in migration; it arrives in numbers early in April and the bulk depart late in October. A few of the birds may pass the winter in the State, the only warblers that do so. They are enabled to survive that season by feeding upon certain berries of which the wax-covered fruits of bayberry and poison ivy are most important. Red cedar berries also are eaten, other wild fruits are pecked at more or less, and a meal is sometimes made of pine seeds. These things are taken during the season when insects are not available; when these do become active the Myrtle Warbler changes to an insect diet so far as the supply will permit. Thus in early spring these birds may be seen

feeding on the stone-flies that are so common along streams at that season. As summer comes on the whole range of insects are made to pay toll. Leaf beetles, round-headed wood borers, weevils, bark beetles, ants, caterpillars, scale insects, and plant lice are enemies of the forest that the Myrtle Warbler feeds upon. Mr. Forbush reports the birds to prey upon wooly aphids (*Schizoneura lanigera*) and upon birch lice ('07, p. 203). The bird takes some flies, also, as well as hymenoptera, psocids, and spiders. This pretty, sprightly, and common little bird, in most of its activities is a friend of the woodlot.

MAGNOLIA WARBLER. *Dendroica magnolia* Wilson.

Summer Resident

The beautiful Black and Yellow Warbler is a common summer resident of the higher parts of the Catskill and Adirondack regions, and breeds sparingly in local cool spots elsewhere in the State. It comes in spring early in May and leaves New York during early October. So far as known its food in our region consists entirely of insects and associated creatures, as spiders and daddy-long-legs. Almost all of its known items of insect food are sorts injurious to woodlands. It takes weevils, leaf beetles, and click beetles, leaf hoppers, plant lice, and scale insects, sawfly larvae and ants, and caterpillars and moths. Surely a record of good deeds to match the excellence of appearance of this feathered gem.

OVEN-BIRD. *Sciurus aurocapillus* Linnaeus.

Summer Resident

This is a ground warbler, and it is the most common bird inhabitant of the forest floor in the State. It arrives in late April, departs early in October, and breeds in all parts of New York. The Oven-bird is called also Teacher-bird from its ordinary song which is a repetition with increasing loudness and emphasis of notes suggesting the word 'teacher.'

While most of the other warblers glean their food from the trunks or limbs or leaves of trees, the Oven-bird turns over fallen leaves and scans the leaf mould of the forest floor. Here it finds weevils, click beetles, and leaf beetles, moths and caterpillars, ants, grasshoppers, spiders, daddy-long-legs, millipeds, and snails. It takes a few seeds and wild fruits also, which amount, however, to but little more than a fiftieth of its entire food. Thus this familiar species does no harm, while it constantly aids in keeping down the number of woodland insects.

REDSTART. *Setophaga ruticilla* Linnaeus.

Summer Resident

The Redstart breeds in all parts of New York, spending the season from late April to early October in the State. Eaton says of it: "The Redstart prefers a deciduous woodland with plentiful undergrowth of saplings and low trees. I have found it nesting in low, damp woods as well as in dry, well-drained upland woods; also in mixed woodland with a considerable growth of pine or hemlock, and in the Adirondacks where spruces occupy half the ground. This flaming little warbler is one of the liveliest of the family, continually fluttering about among the foliage, and darting after flying insects." ('14, p. 465.)

Rations for the Redstart consist, so far as we know, entirely of insects, spiders, and daddy-long-legs. Beetles, including flea beetles, leaf beetles, and round-headed wood borers; caterpillars, and moths; and such true bugs as spittle insects, tree hoppers, and leaf hoppers are commonly taken. The Redstart devours also some hymenoptera, mayflies, and diptera including crane flies. Busy at all times in the pursuit of its insect prey, the Redstart in the long run must account for vast numbers of the forms that are injurious to trees.

CATBIRD. *Dumetella carolinensis* Linnaeus.

Summer Resident

The Catbird comes to New York in the latter part of April and leaves in late October. It nests in all parts of the State except the higher mountainous regions; elsewhere it is one of the most common and best known birds. It is not a true woodland inhabitant but will be found about the edges of every woodlot, in brushy clearings, and along overgrown fence-rows.

Small fruits are a great attraction to the Catbird, composing something more than half of the entire food. About berry patches and cherry orchards, therefore, the species is likely to be a nuisance. Elsewhere its appetite for fruit is appeased by the abundant wild supply, among which its favorite kinds are blackberries and raspberries, wild cherries, elderberries, blueberries, mulberries, and fruits of sumac and smilax.

About 44 per cent of the diet of the Catbird is made up of insects and other invertebrates, and three-fourths of this quantity is contributed by ants, beetles, caterpillars, and grasshoppers. Among the ants are numerous carpenter ants which are given to hollowing out trees. The beetles include numerous forms detrimental to the forest,



Fig. 13. Blue Jay.



Fig. 14. Crow.

as leaf chafers, goldsmith beetles, junebugs, nut weevils, bark beetles, and other weevils of which one (*Epicaerus imbricatus*) feeds on the leaves of the wild cherry, another (*Listronotus latiusculus*) bores in red cedar, and another, the New York weevil (*Ithycerus noveboracensis*), feeds on the buds and twigs of numerous deciduous trees. Other injurious beetles taken are the round-headed wood borers, including the ash borer (*Neoclytus caprea*), leaf beetles, including the grapevine flea beetle (*Fidia viticida*) and the locust leaf miner (*Odontota dorsalis*).

The caterpillars known to be eaten include case-bearers (*Colco-phora*) of which 53 were found in a single stomach, and larvae of the gypsy moth. "Mr. F. H. Mosher watched two pairs of Catbirds and their young in 1895, and found that the young were fed very largely on gypsy caterpillars. He says: 'The Catbird when feeding is most busy in the morning until about 8:40. From that time she comes occasionally until from 3 to 4 o'clock, when she is more active again. In the morning she would come and eat two or three herself, and then carry one to her young. She would be absent about five minutes. After she had made two or three trips she would not stop to eat any herself. In the afternoon, during her period of greatest activity, she would make trips about every ten minutes. She seemed to prefer larvae to pupae, but when hard pressed would take pupae. The size of the larvae seemed to make no difference to her, as she took the full-grown just as readily as the small.' Mr. Mosher thought in 1895 that the Catbird was, next to the Cuckoos and Orioles, the most important enemy of the gypsy moth." (Forbush, '07, p. 184.)

Plant lice, leaf hoppers, tree hoppers, psyllids, cicadas, sawflies, and white ants are additional enemies of trees that the Catbird consumes. Pests included in the bird's food that are of interest from standpoints other than that of the forester are the Japanese beetle, clover-root weevils, billbugs, the strawberry crown girdler (*Otiorrhynchus ovatus*), the spotted cucumber beetle, the potato beetle, adults of wireworms, the chinch bug, cutworms, deer flies, and horse-flies.

Besides the larger groups of insects previously referred to there are included in the Catbird's menu dragon flies, mayflies, caddis flies, such other invertebrates as sowbugs, earthworms, daddy-long-legs, spiders, millipeds, centipeds, and snails, and among vertebrates an occasional small tree frog.

From the forester's standpoint alone, ignoring destruction of cultivated small fruits, the Catbird is a beneficial, and no doubt at times, a very helpful species.

BROWN THRASHER. *Toxostoma rufum* Linnaeus.

Summer Resident

The so-called "Brown Thrush," one of the best bird songsters of New York, inhabits all but the mountainous regions of the State, but is much less common than the Catbird. It likes thickets, brushy clearings and fence-rows, and is a bird of the edges rather than of the body of the forest. The Brown Thrasher is in the State from mid-April until late October.

During this period about 36 per cent of its food is derived from the vegetable kingdom. The important items are wild fruits, mast, and corn. The corn taken is chiefly waste, the mast is largely acorns, and the favorite wild fruits are strawberries, bayberries, wild cherries, sumac berries, blackberries, elderberries, and blueberries.

Half of the insects eaten by the Thrasher are beetles, and the other important items of animal food are caterpillars, grasshoppers, ants, bugs, spiders, millipeds, and snails. Food objects of lesser importance are sowbugs, daddy-long-legs, centipeds, and small batrachians and lizards. Insects in the Thrasher's diet that are of especial interest in connection with woodlands are leaf chafers, Junebugs, nut weevils, the wild cherry leaf weevil (*Epicacrus imbricatus*), oak weevil (*Eupsalis minuta*), round-headed and flat-headed wood borers, leaf beetles, the yellow-necked caterpillar (*Datana ministra*), larvae of the gypsy moth, tent caterpillars, carpenter ants, cicadas, leaf hoppers, and tree hoppers. Pests of more agricultural interest devoured by the Thrasher include the rose beetle, Japanese beetle, strawberry crown girdler, clover-root weevil, billbugs, spotted cucumber weevil, cutworms, wireworms, and the chinch bug.

The Brown Thrasher is not so fond of cultivated fruit as the catbird, its attentions to grain crops are immaterial, and its food habits on the whole are commendable. Though inhabiting merely the fringes of the forest, Brown Thrashers in New York must annually account for thousands of individual pests of the woodlot.

HOUSE WREN. *Troglodytes ædon* Vieillot.

Summer Resident

Many do not think of this familiar species of the dooryard as a woodland bird, but so it is in part. A cavity in a fence post or in a decaying tree is accepted as readily by the House Wren as the best constructed bird house, hence the bird is not infrequently encountered far from the abode of man. In New York the House Wren is a common summer resident except in the higher parts of the mountains; it arrives in late April and departs in early October.

This wren feeds almost entirely upon animal matter, the few seeds and other vegetable items found in stomachs apparently being picked up accidentally. More than 98 per cent of the total food is animal in nature, and half of that is composed of grasshoppers and beetles; other important items are caterpillars, bugs, spiders, and ants.

Insects which forage on the forest are not overlooked by the House Wren as proved by occurrence of the following items in stomachs examined; eggs of walking-sticks, leaf beetles (including *Systema tenebrata*, *Tymnes tricolor* and *Xanthonia decemnotata*, which feed on oak, and *Typhophorus canellus* on various deciduous trees), round-headed wood borers (including *Psenocerus supernotatus* which attacks dogwood, *Phymatodes amoenus*, a pest of grape, and *Smodicum cucujiforme*, a general feeder), weevils (including *Listronotus latiusculus*, a borer in cedar, and bark beetles), leaf hoppers, tree hoppers, plant lice, spittle insects, and cicadas. These are in addition to its favorite caterpillars of which many are destructive to trees.

The House Wren feeds on a number of garden and field pests also, and resorts to some extent to the following sources of food not previously mentioned: flies, crickets, mayflies, dragon flies, daddy-long-legs, millipeds, sowbugs, ticks, mites, and snails.

Jenny Wren is so energetic a personage that she takes more meals per day, and feeds her young oftener, than the average bird. This increases her capacity for destroying insects, and we may congratulate ourselves on the fact that most of them are of kinds we are well rid of. Both in garden and forest this wren is useful so far as its food habits are concerned.

WINTER WREN. *Nannus hiemalis* Vieillot.

Resident

"In New York this little wren is a summer resident of the Catskills and Adirondacks and of various localities of central and western New York, but is most of all a common transient visitant in all the more inhabited parts of the State, arriving commonly from the 25th of March to the 5th of April and passing northward from the 25th of April to the 10th of May. . . . In the fall it is seen mostly during October and early November." (Eaton, '14, p. 485.) A few remain in winter in warmer parts of the State. "The Winter Wren delights in rocks and brush heaps and rubbish in the wildest parts of the mountains and higher valleys, along the edges of the dashing torrents, and in the silent depths of the forest, as well as the moss-covered logs and rocks of the humid slopes." (Ibid, p. 486.)

Vegetable food is of practically no interest to the Winter Wren; the bird wants flesh and its choice of meat most commonly strikes upon such creatures as the beetles, true bugs, spiders, caterpillars, and ants and other small hymenoptera. By contrast grasshoppers, crickets, crane flies, moths, millipeds, and snails are minor items of food, and dragon flies, daddy-long-legs, mites, pseudoscorpions, and sowbugs are merely tasted. Forest insects consumed are bark beetles and other weevils, round-headed wood borers, leaf beetles, leaf hoppers, plant lice, lace bugs, ants, sawflies, and caterpillars.

Not much is known of the particular species of these pests eaten by the Winter Wren, but the riddance of any of them is welcome, and we may be sure that this incessantly active and happily singing feathered mite is a true friend of the forest.

BROWN CREEPER. *Certhia familiaris americana* Bonaparte.

Resident

"This little bird, which is the only representative of its family in New York, may be easily distinguished from all of our other tree-creeping birds by its principal color matching so closely the tree bark, its slender curved bill, and its long tail which is held against the tree for a support, like the tails of woodpeckers." (Eaton, '14, p. 492.) The Brown Creeper is a common summer resident in the Adirondacks and Catskills, and breeds locally in other parts of the State. A few individuals of the species winter in New York and they are joined in early April by migrants from the south.

The Brown Creeper is thoroughly a creature of the trees, its whole life almost being spent in a tireless scrambling over and scanning of their bark. The bird must have a close and important relation with forest insects, but unfortunately studies have not yet been made that disclose the details of its food habits. However, we know that it devours weevils, leaf beetles, flat-bugs, jumping plant lice, leaf hoppers, scale insects, eggs of katydids, ants, other small hymenoptera, sawflies, moths, caterpillars, cocoons of the leaf skeletonizers (*Bucculatrix*), pupae of the codling moth, spiders, and pseudoscorpions. It takes only a little vegetable food, chiefly mast. Most of the insects the Brown Creeper is known to feed upon are injurious to trees and we may safely reckon this small but very close associate of trees as one of their good friends.

WHITED-BREASTED NUTHATCH. *Sitta carolinensis* Latham.

Resident

The White-breasted Nuthatch hardly migrates at all and is resident in all parts of New York except the spruce and balsam belt of

the Catskills and Adirondacks. Nuthatches are forever clambering over trees, coming head first when descending, the only birds having such a trait, which has earned them in some places the name of "Devil Downheads." The White-breast has been observed to feed freely on beechnuts, to devour acorns and hickory nuts, to take maize from cribs, and to be very fond of seeds of sunflowers. These observations point to a fondness for mast which is characteristic of the nuthatch tribe. During the winter months nearly all of the food is mast, while through the spring and summer, much animal food is taken, often to the full capacity of the bird's stomach.

This is derived chiefly from the ranks of beetles, spiders, caterpillars, true bugs, and ants and other small hymenoptera. Besides these some flies, grasshoppers, moths, and millipeds are eaten. Among the insect food items known to have a detrimental relation to the forest are nut weevils, the locust seed weevils (*Spermophagus robiniae*), round-headed wood borers, leaf beetles, tree hoppers, psyllids, scale insects, caterpillars, and ants. The White-breast has been observed to feed also on larvae of gall flies, eggs of plant lice and of fall cankerworms, oyster scale (*Lepidosaphes ulmi*), and upon larvae of the gypsy moth and forest tent caterpillars.

As in the case of other mast-eating birds there is always the question as to whether more harm is done in consuming tree seeds than good in distributing them, but we are forced to conclude that the usual abundance of tree seeds almost precludes the possibility of harm being done by birds eating them, except under very unusual conditions. In the long run, the White-breast, no doubt, destroys a large number of forest pests, and while not so valuable as some of the more highly insectivorous birds, still deserves protection.

RED-BREASTED NUTHATCH. *Sitta canadensis* Linnaeus.

Resident

This nuthatch occupies in summer, that part of New York not used as a breeding range by the White-breast, namely the coniferous forests of the Adirondack and Catskill mountains. Most of the birds winter in the State but there is a noticeable migration also, chiefly in April and October. Unfortunately we know very little about the food of this species. It is very fond of the seeds of pines, spruces, and the like, which it takes in lieu of the larger mast favored by the White-breast. The animal food is known to include beetles, hymenoptera, and spiders, and among forest pests it has been observed to feed on the ribbed pine borer (*Rhagium lineatum*). No doubt the Red-breast does its modicum of good to compensate for the tree seeds which it draws from a store which usually is superabundant.

CHICKADEE. *Penthestes atricapillus* Linnaeus.

Resident

The Chickadee (Fig. 19) is as nearly resident as any bird becomes, and inhabits every county of New York State. It is common, is one of the tamest of our birds, and consequently is one of the best known. Let a man start investigating something, or working in the woods, and he will soon have Chickadees as curious spectators, or even as enthusiastic cooperators in what he is doing. These little fellows delight to pick out and devour the grubs and adult insects revealed by the operations of woodchoppers, and become so intent in the search even as to perch on the axes of the workmen.

About three-tenths of the food of the Chickadee is vegetable, and seven-tenths animal. Mast and wild fruits supply the bulk of the vegetable food. The mast is derived chiefly from coniferous trees, and the favorite wild fruits are the wax-covered berries of bayberry and poison ivy. A good many blueberries also are eaten, but only limited numbers of other wild fruits and seeds.

The important things in the animal food of the Chickadee, in order, are caterpillars and eggs of lepidoptera, spiders, beetles, true bugs of various kinds, and ants, sawflies, and other hymenoptera. The Chickadee certainly consumes a great many spiders (which are moderately useful), but the occurrence seems inseparably connected with the bird's mode of feeding, ever prying as it does, under bark scales and into all sorts of crannies which are the favorite hiding places of spiders. It is just these methods, however, that enables the Chickadee to find so many of the eggs of injurious lepidoptera and plant lice, and scale insects and other minute pests, the consumption of which is so praiseworthy. The good the bird does in consuming these tiny terrors is so great that we must regard as far outweighed, the harm done in feeding upon spiders and parasitic hymenoptera.

It is the prominence of insect eggs in the dietary that especially characterizes the feeding habits of the Chickadee. In New Hampshire, Prof. C. M. Weed found that a fifth of the winter food of Chickadees consisted of the eggs of plant lice. He obtained evidence that as many as 450 such eggs might be eaten in one day by a single Chickadee. The average flock of Chickadees numbered 13, but putting it at 10, and the number of eggs consumed daily by each bird at 100, a destruction of plant lice eggs by the flock, amounting to 1000 a day or 100,000 during the winter, was indicated ('98, p. 86).

The Chickadee is very fond of the eggs of moths, also, especially those of the parents of the tent caterpillars. It devours the eggs of

the fall cankerworm which it finds on twigs in the winter, and it attacks the spring cankerworm moths as the females are laying their eggs. Mr. C. E. Bailey, working under the direction of Mr. E. H. Forbush, State Ornithologist of Massachusetts, found Chickadees devouring about 30 female cankerworm moths per day during the egg-laying season of 25 days. As the moths contained 185 eggs each on the average, the destruction of eggs by a single Chickadee was estimated at 5550 in a day and 138,750 during the laying season of the moths (Forbush, '07, p. 170).

Codling moths and their larvae and pupae, the larvae, chrysalids, and adults of the gypsy and browntail moths, birch, willow, and apple plant lice, the pear psylla, and various scale insects are eaten by the Chickadee. Among these scales are one affecting dogwood (*Lecanium corni*), the black-banded scale (*Eulecanium nigrofasciatum*) which is quite injurious to maples, the scurfy elm scale (*Chionaspis americana*), and the oyster scale (*Lepidosaphes ulmi*), which attacks many trees and has been known to kill ashes and poplars in New York.

Among other forest pests attacked by our friend the Chickadee are the flat-headed and round-headed wood borers, leaf beetles, the white pine weevil, nut weevils, bark beetles, tree hoppers, spittle insects, cicadas, leaf hoppers, and sawflies. Other food items of the bird include a variety of beetles, bugs, flies, and grasshoppers, and a few stone flies, dragon flies, daddy-long-legs, millipeds, snails, and small amphibians.

Sanderson, as a result of his studies of the bird in Michigan, estimated that Chickadees destroy eight billion insects yearly in that State. For New York, with a somewhat smaller land area, the estimate would be something more than six and a half billion insects—a very large number indeed. When we recall that a large share of these—perhaps a third—are destroyed during the winter when no reproduction is possible, it becomes evident that the Chickadee is a very effective agency in cutting down the numbers of insects. When we reflect furthermore, that many of these insects are the very worst woodland pests, we must credit the Chickadee with being a most useful friend of the forest.

GOLDEN-CROWNED KINGLET. *Regulus satrapa* Lichtenstein.

Resident

The Golden-crowned Kinglet nests in New York only in the higher Catskills and Adirondacks, where it is one of the commonest summer birds. In the remainder of the State it is a common migrant,

chiefly in April and October. The Kinglet is one of our smallest birds, has habits much like those of the Chickadee, and seems as highly expert in inspecting all parts of the trees from the trunks to the outermost buds. Although no scientific study has yet been made of the food habits of the Golden-crown in the East, we may be sure that the little fellow is searching only for insects and other small morsels of animal food in its constant and restless reconnoitering of our trees. If we may apply to eastern conditions the findings of a study of the species in California, we may be sure that the Kinglet consumes little if any vegetable food, and that it gets numerous spiders as well as a variety of small insects principally of the hymenoptera, beetles, bugs, and flies. Moths, caterpillars, and small grasshoppers also are devoured. Forest pests taken are leaf beetles, leaf hoppers, plant lice, and scale insects. The birds have been observed by Mr. Forbush to feed assiduously on eggs of plant lice in Massachusetts ('07, pp. 162-163). Despite scanty information we may rest assured that the Kinglet is not only a busy but an effective worker for the welfare of the forest.

RUBY-CROWNED KINGLET. *Regulus calendula* Linnaeus.

Transient

This Kinglet may rarely be seen in extreme southeastern New York in winter, and there is a possibility that it may breed in the highest Adirondacks. However, it is most properly designated as a transient, a role in which it is abundant in season throughout the State. The chief periods of passage are April-May, and October.

As in the case of the Golden-crown no study of the food habits of eastern Ruby-crowns has been made. Professor Beal has reported on the diet of the species in California and we may take his findings as indicating in a general way the food habits of the bird in New York. Vegetable matter was practically ignored by the California Ruby-crowns, and among the 99 per cent of animal food, ants and other hymenoptera, bugs, beetles, and flies were the important elements. Tree-feeding insects identified were lace bugs, plant bugs, leaf hoppers, plant lice, psyllids, mealy bugs, scale insects, caterpillars, and bark beetles.

Professor Beal summarizes his study of the species as follows: "Its vegetable food contains no useful elements and its small size, which precludes the possibility of doing much harm to the products of industry, just fits it to cope with those minute pests against which man often finds himself so powerless." ('12, p. 35.)



Drawn by Edmund J. Sawyer

PLATE 4. BIRDS OF THE BRANCHES AND FOREST CROWN

1, 2, Scarlet Tanager
(male and female).

3, Red-eyed Vireo.

4, 5, Magnolia Warbler
(male and female).

6, Wood Pewee.

7, White-breasted Nuthatch.

8, 9, Black-throated Green Warbler
(male and female).

10, Blackburnian Warbler.

11, 12, Parula Warbler
(male and female).

13, Blue-headed Vireo.

WOOD THRUSH. *Hylocichla mustelina* Gmelin.

Summer Resident

The Wood Thrush is common in the southeastern part of New York as well as in the western part of the State in all mixed and deciduous woodlands which are well watered and provided with a fair stand of undergrowth (Eaton, '14, pp. 516-517). In more northern parts of the State, it is less common and somewhat irregular in occurrence. The Wood Thrush comes to New York in late April and departs before the middle of October. It is a fairly tame species and has a charming organ-toned voice.

Occasionally the Wood Thrush visits cultivated patches of strawberries or blackberries, but most of the fruit eaten is obtained from the wild. Mulberries, wild cherries, dogwood berries, and blueberries, besides wild representatives of the sorts previously mentioned are its favorites. Fruits make up practically the whole of the vegetable sustenance, 40 per cent of the entire diet.

The important items in the 60 per cent of animal food are beetles, caterpillars, and ants, with other hymenoptera, flies, bugs, grasshoppers, millipeds, and spiders, of lesser value to the bird. Besides these a few sowbugs, snails, and earthworms are eaten. Insects injurious to trees which the Wood Thrush feeds upon include besides the ants and caterpillars previously mentioned, the two-lined chestnut borer (*Agrilus bilineatus*), rounded-headed wood borers, leaf chafers, junebugs, leaf beetles, oak weevils (*Pandeletejus hilaris*, *Eupsalis minuta*), a red cedar borer (*Listronotus latiusculus*), nut weevils, plant bugs, cicadas, leaf hoppers, tree hoppers, sawfly larvae, walking-sticks, and termites or white ants. The Wood Thrush has been reported to feed also upon the forest tent caterpillar, and larvae of the gypsy and browntail moths, the rose beetle, and spring and fall cankerworms.

The Wood Thrush eats few useful insects but many harmful ones, it seldom damages cultivated fruits and then usually to no great extent. It is a beautiful and melodious woodland friend, and should be a constant object of our protective care.

VEERY. *Hylocichla fuscescens* Stephens.

Summer Resident

The Veery prefers a damper, swampier forest than the Wood Thrush and is usually common in those which are flooded early in the season, and in May and June have a dense ground cover of shrubs, moss-covered logs, and thick herbage (Eaton, '14, pp. 520-

521). The bird reaches New York in late April and departs in September; it is a common summer resident over most of the State except Long Island and the higher mountainous areas.

This bird scarcely enters the orchard and garden, hence the fruit which it consumes (and that practically the whole of the vegetable food) is wild. It composes about four-tenths of the subsistence, the preferred kinds being juneberries, strawberries, blackberries, wild cherries, sumac and dogwood fruits, blueberries, wild grapes, and elderberries.

Beetles, ants and other hymenoptera, caterpillars, grasshoppers, and spiders are the principal constituents of the six-tenths of its food which the Veery derives from the animal kingdom. A few sowbugs and snails also are eaten. Click beetles (the parents of wireworms), round-headed and flat-headed wood borers, leaf chafers, junebugs, leaf beetles, the strawberry crown girdler, the plum curculio, clover root borers, bark beetles, plant bugs, and sawfly larvae are especially injurious insects devoured by the Veery.

The bird seems to do little or no harm, and feeds on various destructive insects, so deserves protection for its usefulness, as well as it does in an eminent degree for being an adornment to the forest, both in appearance and in song.

GRAY-CHEEKED THRUSH. *Hylocichla aliciae* Baird.

Summer Resident

Two forms or subspecies of Gray-cheeked Thrush occur in New York, the type subspecies (*Hylocichla aliciae aliciae*) which is a transient only, and Bicknell's Thrush (*Hylocichla aliciae bicknelli*) which breeds in the higher Catskills and Adirondacks. The extreme season for the occurrence of these thrushes in the State is from early May to late October.

The Gray-cheeked Thrushes seem to be more fond of animal food than most of their near relatives, making it three-fourths of their diet. The fourth of the subsistence derived from the plant world consists entirely of wild fruits of which the favorite kinds appear to be those of dogwoods, wild cherries, and wild grapes. The birds have been observed to feed freely upon sour gum and pokeweed berries also.

Beetles make up about a third of the food of the Gray-cheeks, ants and other hymenoptera, a fifth, with caterpillars and moths, bugs, and spiders of considerably less importance. Snails, millipeds, and a variety of other invertebrates are minor items of the

food. Forms injurious to woodlands include the periodical and other cicadas, caterpillars, sawfly larvae, ants, leaf beetles, round-headed and flat-headed wood borers, leaf chafers, junebugs, nut weevils, bark beetles, and other weevils (among them an oak weevil, *Pandeletejus hilaris*, and the sapwood borer, *Hylobius pales*).

Professor Beal's conclusion regarding the Gray-cheeked Thrushes can well be quoted here. "The vegetable food drawn entirely from nature's great storehouse, contains no product of human industry, either of grain or fruit. Whatever the sentimental reasons for protecting this bird, the economic ones are equally valid." ('15, p. 13.)

OLIVE-BACKED THRUSH. *Hylocichla ustulata swainsoni* Tschudi.

Summer Resident

The Olive-backed Thrush is a common summer resident of the higher Catskills and Adirondacks, and is abundant over most of the State in migration, chiefly in May and September. As in the case of the other thrushes the food is about six-tenths animal and four-tenths vegetable. The latter, in the case of this denizen of remote forests, consists entirely of wild fruits, of which those of pokeberry, blackberry, wild cherries, dogwoods, wild grapes and elderberries are most important. The large items of the animal food are ants and other hymenoptera, beetles, and caterpillars; lesser ones are flies, bugs, and spiders; millipeds, snails, sowbugs, earthworms and the like being merely sampled. Forms of interest as enemies of the forest are carpenter ants, leaf chafers, junebugs, round-headed wood borers, leaf beetles, nut weevils, a pine weevil (*Pachylobius picivorus*), bark beetles, the red-humped oak caterpillar (*Synumerista albifrons*), sawfly larvae, plant bugs, tree hoppers, leaf hoppers, cicadas, plant lice, and scale insects. The Olive-back takes no toll from our cultivated fruits, but in his chosen woodland haunts renders constant service as a guardian of our trees.

HERMIT THRUSH. *Hylocichla guttata* Pallas.

Resident

The Hermit Thrush is a summer resident of the higher parts of the Catskills and Adirondacks and of the colder swamps, gullies, and hill slopes of other parts of the State. It is a common migrant throughout New York, chiefly in the months of April, May, October, and November. It even remains in winter in the southeastern part of the State.

Following the usual Thrush formula in diet, that is, about 60 per cent animal and 40 per cent vegetable food, the Hermit agrees

with the shy species of its tribe in keeping so close to its wooded retreats, that the products of the farmer are in no wise molested. As in the case of the other thrushes the vegetable foil to its animal fare consists almost exclusively of wild fruits. Those of red cedar, green brier, bayberry, hackberry, pokeberry, juneberry, sumac, black alder, Virginia creeper, dogwoods, and blueberry are most frequently taken.

Like the other thrushes the Hermit is an inveterate foe of ants and makes more than a tenth of its food of them. Ants and other hymenoptera, together, lead among items of animal food, beetles and caterpillars ranking next. Bugs, flies, crickets, and spiders also are consumed in fair quantity, and millipeds, sowbugs, snails, and angleworms are sparingly devoured.

Besides the ants and caterpillars, pests of trees more definitely identified are leaf chafers, junebugs, round-headed and flat-headed wood borers, leaf beetles (including an oak-feeder, *Xanthonia 10-notata*; the willow flea beetle, *Crepidodera helxines*; and a birch leaf feeder, *Syncta ferruginea*), oak weevil (*Pandeletejus hilaris*), red cedar borer (*Listronotus latiusculus*), nut weevils, the turpentine bark-beetle (*Dendroctonus terebrans*), plant lice, plant bugs, cicadas, leaf hoppers, tree hoppers, jumping plant lice, and sawfly larvae.

The Hermit Thrush spends its life among the trees, does nothing to molest them, and in many ways befriends them. It is regarded by all who have heard it, as an inspired songster, it is a beauty in form and color, and as we see from an account of its food it is a profitable tenant of the forest.

ROBIN. *Planesticus migratorius* Linnaeus.

Resident

The Robin (Fig. 20), everybody's bird, usually nests near the habitations of man, but Eaton says, "It does still frequent the woods, however, to a considerable extent, and I have found it breeding in the slashings of the Adirondack forest, miles from any settler's house and in the woods near the lumber camp or the open summer camp of tourists in all portions of the North Woods" ('14, p. 529). Robin Redbreast is an abundant summer resident in all counties of New York; it comes to the State very early, sometimes in late February, and most of the birds leave before the last of November. Some, however, spend the winter "where they have swamps or cedar thickets or a sheltered gully to which they may retreat, and a convenient supply of wild grapes, barberries, wild privet, poison ivy

and juniper berries to furnish them abundant nourishment." (Eaton, '14, p. 531.)

Our knowledge of the feeding habits of the Robin is based mainly of course on studies of the bird as it ordinarily occurs, near to man and his works. We do not have particular information on the mode of life of the woodland Robins. We may, however, be assured on two points, namely that cultivated fruits do not play the part in the diet of these birds that they do in the case of our (in this respect, too familiar) neighbors, and that wild berries therefore are of much greater importance to this fruit-loving bird.

Like the true thrushes the Robin approves of a 60-40 dietary composition, but in a reverse sense, the larger item in its case being vegetable rather than animal food. There is no question about Robins sometimes taking too much cultivated fruit, thus necessitating reduction in their numbers. However, the woodland Robins with which we are here especially concerned have little or no part in these depredations, and their fruit-eating is a benefit rather than an injury because it results in the planting of numerous trees and shrubs. The favorite wild fruits of New York robins are those of red cedar, greenbrier, mulberry, pokeweed, juneberry, blackberry and raspberry, wild cherry, sumac, woodbine, wild grape, dogwood, and blueberry.

Beetles and caterpillars are the items of animal food taken in greatest quantity by the Robin, with bugs, hymenoptera, flies, and grasshoppers of considerably less importance. Spiders, earthworms, millipeds, sowbugs, and snails are additional sorts of animal food worth mentioning.

Various insects which are pests or near pests in woodlots have been identified from stomachs of Robins and we may be sure that a special study of Robins actually living in forests would greatly increase the list. The kinds now known to be on the Robin's bill-of-fare are: leaf chafers, Junebugs, the rose beetle (*Macrodactylus subspinosus*), leaf beetles (including the locust leaf beetles, *Colaspis brunnea* and *Nodonota tristis*; locust leaf miner, *Odontota dorsalis*; and variable leaf beetle, *Typophorus canellus*), nut weevils, cherry leaf weevil (*Epicaerus imbricatus*), flat-headed and rounded wood borers (including among the latter an oak borer, *Lepturges querci*; and the poplar borer, *Saperda calcarata*), the yellow-necked apple worm (*Dataua ministra*), the red-humped apple-tree caterpillar (*Schizura concinna*), orchard tent caterpillar (*Malacosoma americana*), American silkworm (*Samia cecropia*), forest tent caterpillar

(*Malacosoma disstria*), the yellow-striped oak caterpillar (*Anisota senatoria*), the larvae of the gypsy moth (*Porthetria dispar*), brown-tail moth (*Euproctis chrysorrhæa*), the spiny elm caterpillar (*Euwanessa antiopa*), the tussock moth (*Hemerocampa leucostigma*), carpenter ants, plant lice, plant bugs, cicadas, tree hoppers, and saw-fly larvae.

In the economic court the Robin of the forest, and the Robin of the houseyard, must be adjudged separately, and regardless of the fact that it is differences in opportunities largely, that gives the former a much better character than the latter. The forest Robin has no chance at cultivated fruits and it has much greater opportunities to devour woodland insect pests. As we have seen, it improves these opportunities and should be credited accordingly. In the woodlot the Robin is certainly more beneficial than injurious.

BLUEBIRD. *Sialia sialis* Linnaeus.

Resident

The Bluebird, cheery harbinger of spring, and only less domestic in its tastes than the Robin, like that species is scarcely a true woodland bird. Where cavities in trees or posts are available for its nests, however, it lives about the edges of woodlands, along old, overgrown fence rows, and in tree-dotted pastures. The Bluebird is common in all parts of New York, the first migrants in spring usually arriving in February, and those of the fall lingering until mid-November. Some of the birds winter in the southeastern part of the State.

More fond of animal food than the true thrushes, and considerably more so than the Robin, the Bluebird derives almost seven-tenths of its yearly subsistence from that kingdom. The three-tenths of its diet that is vegetable in origin is chiefly wild fruit, this bird sharing but slightly in the injurious frugivorous tendencies of the Robin. The favorite wild fruits of the Bluebird are those of red cedar, bayberry, pokeweed, blackberry and raspberry, sumac, woodbine, dogwoods, and elderberry.

The large components of the animal food of this bird, in order, are grasshoppers and crickets, beetles, and caterpillars; ants and other hymenoptera, bugs, and spiders are of some consequence, and millipeds, sowbugs, snails, earthworms, and a few other items are of minor import. Insects detrimental to trees which are preyed upon by the Bluebird included leaf chafers, Junebugs, leaf beetles, locust leaf miner (*Odontota dorsalis*), flat-headed and round-headed wood borers (the latter including an oak borer, *Typocerus zebratus*), and the cherry leaf weevil (*Epicaerus imbricatus*), the white pine weevil

(*Pissodes strobi*), one of the commonest enemies of pines in New York State, the elm bark borer (*Hylesinus opaculus*) and other bark beetles, the locust seed weevil (*Spermophagus robiniae*), the green oak caterpillar (*Nadata gibbosa*), cankerworms, leaf hoppers, plant bugs, cicadas, and tree hoppers.

The Bluebird does almost no direct harm to man, and the indirect damage done by feeding on beneficial insects is far overbalanced by consumption of injurious ones. The numbers of Bluebirds frequenting the borders of woodlots can be increased by providing nest boxes, and it will pay the owner to see that this is done.

THE ROLE OF BIRDS IN WOODLOT ECOLOGY

What sort of a factor, and how important a one, are birds in the normal continuance of the woodlot? Like many other questions in ecology, this is difficult to answer categorically, because the things concerned are not simple units, but combinations of diverse elements, which interact in all possible directions and to all varying degrees.

We have in the woodlot list birds which spend only a comparatively few days, spring and fall, among our trees, a second group which stay six months and rear their young among them, and still others that inhabit woodlots the year round. We have some species which come only slightly in contact with trees, and others that live almost exclusively upon them. We have birds that feed but little on insects enemies of the trees, and those that subsist almost entirely upon them, a few species that are decidedly injurious to the welfare of the woodlot, and many that are highly beneficial. Some birds actually domiciled in woodlots may have little relation to the trees, while others may affect them profoundly.

The role of birds in woodlot ecology, therefore, cannot be simply stated, but we can present a picture of these relations that will enable the reader to appreciate that birds are important in woodlot ecology, and to apprehend, in the large, at least, the nature of their role. A convenient arrangement for the discussion of the relationships of birds to woodlots is: damage, direct and indirect, and benefits, under the same divisions.

Direct damage to trees by woodlot birds. The Yellow-bellied Sapsucker is the only New York bird that habitually does significant direct damage to trees. In its quest of cambium and sap, it drills in many kinds of trees holes which remain open long enough to permit, in all cases, access to the wood of water, bacteria, and fungi (see

Figs. 9, 10), and it often makes so many of its girdles of punctures as to kill branches or even entire trees. It is needless to repeat here details of the Sapsucker's work which are described on pp. 38-40, but it can well be stated that the bird is destructive and does little to offset the harm done.

Captious critics have cited as injurious the excavations (see Fig. 7) that the true woodpeckers make in capturing their prey, but when we reflect that the borers they capture, but for the intervention of the woodpeckers, might extend their ravages indefinitely, and give rise to a posterity with multiplied potentialities for destruction, it is obvious that the woodpecker's drilling is the lesser evil. The nest holes made by New York woodpeckers are invariably in dead wood, hence they cause no harm.

Other direct damage (or potential damage) done to trees by birds is the feeding upon buds and seeds. Several of our birds have a distinct taste for buds, notably the Ruffed Grouse, Purple Finch, and Pine Grosbeak, and to a lesser extent other grosbeaks, sparrows, and the Cedar-bird. A fifth of the Pine Grosbeak's food for instance, consists of the staminate flower buds of pine, yet these are produced in such profusion by pine trees that no indications of damage by the Grosbeak have ever been noted. The same principle extends to other cases of budding; buds are so overwhelmingly numerous, and the birds that feed upon, relatively so rare, that damage to forest trees has rarely if ever been noticed. Habitual feeders on seeds (as distinguished from fleshy fruits) of forest trees include the Red-headed Woodpecker, Blue Jay, Evening Grosbeak, Pine Grosbeak, the Crossbills, Redpolls, Pine Siskin, and the Nut-hatches. Under normal conditions, seed-eating also seems to be negligible in relation to the forest, because seeds are produced in such large numbers by trees, and over such a long period of years (in any one of which a good crop would re-seed all the available ground) that actual harm to woodlands from this cause seems never to occur.

Indirect damage to trees by woodlot birds. This sort of damage may result from transmission of tree diseases and pests by birds, by the destruction of too many useful insects by birds, or by undue elimination of beneficial birds by their avian enemies. Birds are known to carry on their feet or plumage spores of the chestnut blight, and Sapsuckers at least distribute other fungous and bacterial diseases of trees. Birds also carry from tree to tree the minute crawling larvae of scale insects. However, in the case of practically every one of these pests or diseases it is obvious that they have so many

means of spread that birds cannot be singled out for special condemnation, and it seems certain that they would be just as widespread as now if not carried at all by birds. The Vireos as a group prey rather extensively upon ladybird beetles, a group of insects which feed freely on plant lice, mealy bugs, and scale insects, and which therefore are quite useful. The Flycatchers and the Scarlet Tanager are examples of birds that prey rather more than is desirable upon the beneficial parasitic hymenoptera. The present paper is no place for a long essay upon the theoretical considerations involved in these inter-relationships of predatory forms, but it may be simply stated that in practice we are accustomed to overlooking the destruction of a modicum of useful insects if the bird doing so has to its credit consumption of an equal or greater quantity of noxious forms. The ladybird beetles eat plant lice and scale insects, the parasitic wasps kill off wood borers and other harmful insects, but the birds eat all of them, friends and foes alike. Their work is analogous to spraying or other insecticidal operations; we seek to destroy certain pests, but if they are plant lice, for instance, and lady beetles are feeding upon them, the latter probably will be wiped out with the former. However, we have accomplished our object, we have relieved the plant of some or all of its direct enemies; we may have done away with some of its friends also, but these lesser protective agencies must ever make way before a greater. In other words the most effective weapon has preference. In economic practice this principle is interpreted to excuse a greater predator (upon the same or similar destructive forms) for feeding upon a lesser.

When we consider the feeding of bird hawks upon the predominantly useful feathered creatures of the forest, however, this principle does not apply, for these hawks are the very ones that fail almost entirely to eat any insects, or other injurious creatures, that are held in check by the birds upon which they prey. The Goshawk, the Sharp-shinned, and Cooper's hawks, almost exclusively bird eaters, therefore must be cried down. We can look with more tolerance upon the occasional falling from grace of other hawks and owls, for they usually are doing something that will compensate for moderate destruction of useful forms. To the degree, however, that they approach exclusive feeding upon beneficial birds, we must condemn them. Sometimes, in its nesting season, with clamorous young to feed, the little Screech Owl, even, creates havoc among its smaller bird neighbors that can scarcely be condoned.

Direct benefits to trees by woodlot birds. There would seem but little chance for birds to be directly beneficial to trees; they cannot help trees grow, cannot increase the numbers of their buds, or flowers, or fruits. However, they do one thing that can fairly be classed as a direct benefit—they extend the tree's mechanism for the distribution of its seeds, that it may occupy new ground and extend its range. Many trees would have very little opportunity for spread, were it not for the birds; their seeds would for the most part fall directly beneath the parent tree and there eventually perish. But when a bird comes along, eats a fleshy fruit, as a wild cherry, it is certain to carry the stone of that fruit some distance (and it may be a long one) before it disgorges it or eliminates it after it has traversed the entire alimentary canal. The majority of our shrubs and smaller trees, and some of the largest as the sour gum, hackberry, mulberry, and black cherry are distributed almost wholly by birds (see Fig. 21). (Cf. Adams, '23a, pp. 493-496.)

For variety's sake, in further elucidation of this subject, we may quote Professor Eaton's remarks on birds in distributing fruit seeds.

"While the inhabitants of New York State have been destroying the forests more rapidly than wise policy would dictate, especially on land which is poorly fitted for any other growth than trees, the birds have been overcoming to some extent the evil effects of excessive deforestation. As one drives across the country, the roadside and fence row bear abundant evidence to the effects of planting by the birds. The sweet cherry and the black tartarian have been scattered along every fence row, roadside, and the edges of the forests throughout the greater portion of the State. The Robin and the Cedarbird are principally responsible for this planting. In like manner various sections of the country have a pleasing line of junipers along the highways and fence rows planted by the selfsame birds. Likewise, throughout the forest the various dogwoods and viburnums are scattered by all the fruit-eating species . . . especially by the thrushes. In western New York the paniced dogwood has been planted along roadsides and many fence rows and throughout every swamp. The seeds of the shadbush, which brightens the landscape with its showy blossoms, have been scattered by the thrushes and finches. The forester might object that most of these trees are of little use for timber, but there is at least one valuable timber tree which is planted extensively, especially by the Flicker and Robin—the black cherry (*Prunus scrotina*), and to some extent the cucumber



Fig. 15. Baltimore Oriole (above), Orchard Oriole (below).



Fig. 16. Evening Grosbeak (above), Pine Grosbeak (below).

tree (*Magnolia acuminata*) and sour gum (*Nyssa*). If the lumberman is not pleased by the fruit-planting species, the botanist certainly is, for all the fruit-bearing plants must necessarily become exterminated except for the agency of the birds in scattering their seeds throughout the fields and woodland." ('14, p. 50.)

However, birds do aid in broadcasting of the very best timber trees as the pines, hickories, oaks, and chestnuts. Every seed storing bird, as the Red-headed Woodpecker, Blue Jay, and the Nuthatches and Titmice, hoards many a seed that it never eats. Some of these are secreted and others fall in places where they have at least a chance for life. Indeed we can be sure that the effective distribution of heavy fruits of these trees occurs in no other way than through transportation by the hoarding species of birds and rodents.

Indirect benefits to trees by woodlot birds. This class of benefits arises from the destruction by birds of creatures injurious to trees. The principal forest pests upon which this beneficial warfare is waged are mice and insects. Pine mice and to a lesser extent, field mice, feed a great deal on the bark of roots and the underground parts of the trunks of trees. In winter under cover of snow they extend this work above ground and many trees are thus barked so thoroughly that they die from the effects.

Mice destroy tree seedlings also, and rabbits not only bark trees above ground but bite off many young woody plants. The rabbits are as guilty as the mice and would be as emphatically condemned were it not for their game value. It is clear that birds which feed on pine mice, field mice, and rabbits frequenting woodlands do away with some of the most serious enemies of trees, and consequently may be of great benefit. The owls, especially, are diligent woodland mousers, but several kinds of hawks help in the work and their services should not go unrewarded.

SOME FOREST INSECT PESTS AND THEIR BIRD ENEMIES

The leading insect pests of woodlots in New York are mentioned in following pages, with an account in each case of their bird enemies.

PLANT LICE: APHIDIDAE

Plant lice attack all kinds of trees. They are busy sucking up sap from earliest spring throughout the season, and multiply so rapidly that enormous numbers of them accumulate in a short time. Sometimes they are so numerous that the slightly altered sap (honey dew)

excreted by them falls through the trees like rain. They are a steady drain on the vitality of forests and in the aggregate must decrease the production of wood by a very large amount. Definite damage to the health and appearance of trees has been noted in New York in the case of maple, elm, larch, and pine. Dr. E. P. Felt, State Entomologist, states that possibly the most injurious Hemiptera are the "plant lice which year after year make drafts on the vital fluids of various plants and some seasons cause very great injury" ('05, p. 12).

The numbers and importance of plant lice as woodland pests, however, are not more obvious than the fact that they have a multitude of foes among birds. Anyone who notes the behavior of our small migrant birds in spring must be impressed with the fact that plant lice often are their mainstay as a source of food. All of the numerous warbler tribe, the vireos, the kinglets, and even such larger species as the orioles and tanagers, ransack the trees, peering under leaves, prying about buds and flowers, and in general conduct a search that can have as its object only the plant lice so numerous at this season, and which must have a tremendous effect in holding down the numbers of these prolific pests. Prof. E. H. Eaton says: "I have watched them on many occasions and counted from fifteen to seventy-five a minute swallowed by each warbler observed" ('14, p. 48). Mr. E. H. Forbush observed a case in which the work of warblers was so effective as to extirpate a local infestation of plant lice. His account of this experience is as follows:

"One morning in the fall of 1904 I noticed in some poplar trees near the shore of the Musketaquid a small flock of Myrtle and Black-poll warblers, busily feeding on a swarm of plant lice. There were not more than fifteen birds. The insects were mainly imagoes, and some of them were flying. The birds were pursuing these through the air, but were also seeking those that remained on the trunks and branches. I watched these birds for some time, noted their activity, and then passed on, but returned and observed their movements quite closely at intervals all day. Toward night some of the insects had scattered to neighboring trees, and a few of the birds were pursuing them there; but most of the latter remained at or about the place where the aphid swarm was first seen, and they were still there at sundown. The swarm decreased rapidly all day, until just before sunset it was difficult to find even a few specimens of the insect. The birds remained until it was nearly dark,

for they were still finding a few insects on the higher branches. The plant lice I had secured for identification were destroyed or liberated during the night, probably by a deer mouse which frequented the camp; so the next morning at sunrise I went to the trees to look for more specimens. The birds, however, were there before me, and I was unable to find a single aphid on the trees. The last bird to linger was more successful than I, for it was still finding a few; but it soon gave up the effort, and left for more fruitful fields. Probably a few insects escaped by flight; but in examining the locality in 1905 I could not find one. The apparently complete destruction of these insects may have been due in part to the hard winter that ensued, but the effect produced by the birds was most obvious." ('07, pp. 70-72.)

Mr. Forbush and his associates observed 36 species of birds feeding on birch plant lice, and the effectiveness with which some of them devoured their prey easily explains the case of local suppression just cited.

We quote just one of these observations and it clearly shows the great possibilities of plant louse destruction by birds.

"On May 28, 1898," we are informed, "Mr. Mosher watched a pair of Northern Yellow-throats eating plant lice from the birches in the Middlesex Fells Reservation, where these insects swarmed. He was equipped with a good glass, and concealed close to the spot where the birds were feeding, was able to count the number of times each bird picked up an insect. One of these Warblers apparently swallowed eighty-nine of these tiny insects in one minute. The pair continued eating at this rate for forty minutes. Mr. Mosher states that they must have eaten considerably over seven thousand plant lice in that time. It would seem impossible for the birds to crowd that number of insects into their stomachs; but we must remember that the insects were infinitesimal in size, soft-bodied, easily compressed in the stomach, and quickly digested, so that by the time a part were eaten those first taken would be well disposed of, leaving room for more. Mr. Mosher is a very careful, painstaking, and trustworthy observer; undoubtedly his statement is accurate; but, to eliminate any possibility of error, we will assume for purposes of calculation that they ate only thirty-five hundred in an hour.

"A pair of Yellow-throats (presumably the same) were seen to come daily any many times each day to the birch trees which were infested with aphids. Probably they spent at least three hours each day feeding on these insects. If the two birds ate only thirty-five

hundred an hour for three hours a day, they would consume ten thousand five hundred aphids each day, or seventy-three thousand five hundred in a week. It requires no draft on the imagination to see how such appetites may become useful to the farmer if they are satiated on his insect enemies." ('07, pp. 62-63.)

The Biological Survey has found plant lice in the stomachs of 86 species of birds, and records from publications, chiefly those of Forbush, add 19 species to that list. The number of plant lice counted in single stomachs was high in some instances among which we cite the following: Chipping Sparrow, 260; Pine Siskin, 300; Goldfinch, 325; and Nighthawk, 650. Not only plant lice themselves but their eggs also are consumed in large numbers by birds. Two thousand, two hundred and ten eggs of the white birch aphid were found by Kirkland in the stomach of a Goldfinch, and Weed in his report on "The Winter Food of the Chickadee" ('98, p. 86) says that the "destruction of the myriad eggs of plant-lice which infest fruit, shade, and forest trees is probably the most important service which the chickadee renders. . . . more than 450 eggs sometimes occur as the food of one bird in a single day. On the supposition that one hundred were eaten daily by each of a flock of ten Chickadees, there could be destroyed 1000 a day, or 100,000 during the days of winter, a number which I believe to be far below the real condition, could we determine it precisely."

From the data presented, and much more to the same effect might be cited, it is evident that birds are of great importance as enemies of plant lice; and there is no doubt that the destruction wrought by them among the wintering stages of the plant lice is greater than that by any other natural enemies.

SCALE INSECTS: COCCIDAE

Scale insects or bark lice are among the most destructive of insects. Their pernicious effects are most noticeable in orchards and ornamental plantings, but there can be little doubt that woodlot trees also are sometimes as badly affected. Certainly these pests are always present in woodlands and like the plant lice are a constant drain on the vitality of the trees.

Among the notably destructive species occurring in New York are the cottony maple scale (*Pulvinaria acericola*) and the black-banded scale (*Eulecanium nigrofasciatum*)—also a maple pest; both of these are eaten by the Chickadee. The oyster scale (*Lepidosaphes ulmi*) attacks poplars and ashes in particular among woodland trees and has been known to kill ash saplings; it is eaten by the Song Sparrow, Brown Creeper, and White-breasted Nuthatch.

No fewer than 90 species of American birds are known to prey upon scale insects and many of them are species occurring in New York State. All of the woodpeckers, vireos, and warblers eat bark lice and the following birds of other families may be noted for their fondness for these tiny but destructive insects: Baltimore and Orchard Orioles, Rose-breasted Grosbeak, Scarlet Tanager, Tufted Titmouse, and Ruby-crowned Kinglet. As many as 100 specimens of the New York plum scale (*Eulecanium cerasifex*) which feeds also on oak have been found in a single stomach of the Rose-breasted Grosbeak. In fact the record of birds as enemies of scale insects is so good that it inspired one entomologist to remark that: "It is highly probable that these insectivorous birds rank first in the control of the larger kinds of scale insects." (Jarvis, '11, p. 74.)

CICADAS: CICADIDAE

These insects often are called harvest flies or dog-day locusts. The species which attracts most attention is the periodical cicada or seventeen-year locust. While this insect requires seventeen years in which to complete its life history, it occurs at shorter intervals than that in New York due to the fact that six separate broods are represented. The immature stages of cicadas feed at least in part on sap from the roots of the trees and the adults deposit their eggs in twigs which either die and drop off or heal leaving large scars. In the case of the seventeen-year locust this work often results in so general a pruning as to give the trees a brown appearance as if lightly burned over.

Cicadas are large and apparently nutritious insects which have a host of enemies. Among vertebrates, fishes and tortoises, when they have opportunity, frogs, toads, lizards, squirrels, and a multitude of birds prey upon them. Birds ranging in size from the Chickadee to the Red-shouldered Hawk share in the feast. Crows are especially fond of cicadas and are more successful in getting the underground stages than any other birds. In many cases remains of from 20 to 30 cicadas have been found in individual Crow stomachs. More than 80 kinds of birds are known to prey upon cicadas, and we may be sure, in the case of any undue abundance of these insects in New York, that birds will be found doing all they can to reduce it.

WALKING-STICKS: PHASMIDAE

This is the only group of the great series of insects related to the grasshoppers and katyids that is mentioned as being especially injurious to trees. Walking-sticks as their name denotes are very

elongate, stick-like insects, of which only two species occur in New York. One of these (*Diapheromera femorata*) is said to be so abundant at times as to defoliate large areas of deciduous forests. Where such infestations prevail observers report that the patter of the droppings (including eggs) of the insects sounds like rain.

Fourteen kinds of New York birds are known to feed on walking-sticks. They range in size from the House Wren to the Barred Owl, the larger birds taking the insects themselves, and the smaller, including three species of vireos and the wren, their eggs. The latter objects have a curious resemblance to seeds, but evidently this does not deceive some of the birds, as the species eating them are not seed-eaters.

FLAT-HEADED WOOD BORERS: BUPRESTIDAE

The adults of the flat-headed wood borers in general have a metallic appearance and are often ornamented with bright or contrasting colors. The larvae, often called "hammer-heads" are whitish with yellow or brown, large, flattened heads. Some bore in dead or dying plants, some attack healthy trees, and they infest trees and shrubs of almost every kind. One of the flat-headed borers especially destructive in New York is the bronze birch borer (*Agrilus anxius*). It has killed hundreds of white birches, and attacks also other birches, poplars, and willows. Another species of the same genus, namely *Agrilus bilineatus*, has been known to kill oaks and chestnuts, and the habits of all of these beetles are such that it is a credit to birds to feed upon them. All of the vireos and small flycatchers, the orioles and in fact most woodland birds, prey upon the adult *Agrilus*. The Wood Thrush and Wood Pewee are specifically known as enemies of *A. bilineatus*. The woodpeckers are our chief aids in warring upon the larvae, and the Hairy Woodpecker has been known to feed quite extensively upon those of the birch borer. A common flat-headed borer (*Chrysobothris femorata*) infests a number of forest trees and is especially injurious to the apple. This species has been found in stomachs of the Crow, Kingbird, and the Yellow-throated, Red-eyed, and Warbling Vireos. The Downy Woodpecker has been observed to extract the larvae of this pest in considerable numbers. The oak leaf-miners (*Brachys acrosa* and *B. ovata*) are eaten by such birds as the Crow, Traill's Flycatcher, and Red-eyed Vireo. In all, the Biological Survey has found 118 species of birds to feed on adult or larval flat-headed wood borers. The New York birds most active against the adults are the Blue Jay, Red-headed Woodpecker, Kingbird, Great Crested

Flycatcher, and Rose-breasted Grosbeak. The special foes of the larvae are the woodpeckers, particularly the Downy and Hairy, and no fewer than 110 flat-headed borers have been taken at a single meal by a Downy Woodpecker.

LEAF CHAFERS; SCARABAEIDAE

Certain groups of beetles of the family Scarabaeidae are called leaf chafers and they are sometimes so abundant as to do considerable damage to oak, hornbeam, and other trees. However, it can scarcely be the fault of birds that these insects become destructively numerous since leaf chafers are almost as much a staple food for some birds as is bread for the human race. Thirty species of birds are known to feed on members of the genus *Anomala*, the more important among them being the Crow (26 the maximum number of these chafers found in a single stomach), Kingbird (16), Whip-poor-will (18), Nighthawk (37), and Starling (26). Similar data for the genus *Dichelonycha* are: 55 species of bird enemies of which the Chimney Swift (12), Red-eyed and Blue-headed Vireos (14 each), Meadowlark (25), and Kingbird (27), are the most conspicuous. The genus *Euphoria* is another group of leaf chafers, of which the best known species is the brown *E. inda* which buzzes about like a bumblebee over the bare ground in early spring. Forty-one kinds of birds have been found to feed on these beetles, the Crow, Red-headed Woodpecker, Crow Blackbird, and Blue Jay being their most assiduous enemies. Finally we may mention the very important group (*Phyllophaga*) of leaf chafers, familiarly known as junebugs in the adult state and as white grubs when larvae. More than 80 species of birds feed upon them, some of them to a remarkable extent. Crows for instance make about 4 per cent of their entire diet of this single genus of beetles, and out of 2300 Starlings examined 300 had eaten these pests. All kinds of birds from the size of vireos up to the Great Horned Owl eat junebugs, those doing so most extensively being the Crow (85 in a single stomach), Starling (12), Nighthawk (91), Brown Thrasher, Crow Blackbird, and Screech Owl.

LEAF BEETLES: CHRYSOMELIDAE

This family is composed of beetles, which almost without exception feed on plant material both in the larval and adult states. While many of them are pests of cultivated crops, comparatively few have done noteworthy damage in woodlands. The elm leaf beetle (*Galerucella luteola*) is by far the most important tree enemy among

the leaf beetles, and according to Dr. E. P. Felt, State Entomologist of New York, "is in all probability responsible for more ruined elm trees in the Hudson River Valley than all other agencies combined." ('05, p. 46.) The English Sparrow, Yellow-throated and Warbling Vireos, and the Cedar Waxwing or Cedar-bird are known to feed upon the elm leaf beetle, and the last named species has done some excellent clean-up work in this way. At least four instances of local extirpation of the pest by these birds have been noted in Massachusetts. The authority for one of these is the distinguished orinthologist, Outram Bangs, who relates that in Wareham, Mass., Cedar-birds "saved about 20 elm trees from destruction by these beetles. About the year 1904, when the trees were 15 to 20 feet in height, they were badly infested, but waxwings came regularly to the trees in constantly increasing numbers, searching every limb and twig. They often hung from the ends of the boughs like chickadees spying out the insects until they cleared them off. The trees were not afterwards troubled." (Forbush, '21, p. 29.)

A few other leaf beetle pests of woodlots may be briefly noted. A species closely related to the elm leaf pest is the cherry flea beetle (*Galerucella cavicollis*). This species regularly riddles the leaves of both wild and cultivated cherries, but it is preyed upon freely by the Cedar-bird which thus further evens up the score for the cherries it sometimes eats rather freely. The poplar leaf beetle (*Phytodecta pallida*) which often skeletonizes the leaves of poplars has been found in stomachs of the Least Flycatcher and Olive-backed Thrush. A prettily marked leaf beetle (*Calligrapha scalaris*) which feeds on alder, elm, willow, and basswood, sometimes causing serious defoliation, is eaten by the Nighthawk, Cuckoo, and Hermit Thrush. The locust leaf miner (*Chalcus dorsalis*), which has been reported as abundant on Long Island and also in Chautauqua County, and probably is numerous in other localities also, periodically feeds so extensively upon the leaves of black locust that they die and turn brown, giving the trees the appearance of having been burned over. In Maryland twenty kinds of birds were found to devour this insect, and as the same species of birds live in New York it is probable that they will exhibit there also their fondness for the locust leaf miner. The reduction by birds of an infestation of this beetle at Marshall Hall, Md., was observed by Dr. S. D. Judd of the Biological Survey. He states that: "In 1895 the locust leaf mining beetles became over-abundant and turned the beautiful green of the locusts fringing the bluff into an unsightly brown. All the birds, including the sparrows, ate these beetles freely and con-



Fig. 17. Rose-breasted Grosbeak.



Fig. 18. Red-eyed Vireos,

stantly and largely aided by their united attack in reducing the beetles to such an extent that they have not appeared subsequently [i. e., up to 1901, a period of six years] in sufficient force to repeat the damage." ('01, p. 35.)

ROUND-HEADED WOOD BORERS: CERAMBYCIDAE

The adults of this family of beetles are often fairly large and handsomely colored; the larvae are whitish grubs with nearly round heads. The young feed in the trunks, branches, and roots of trees and shrubs, and in the stems of some weeds, but on the whole they are distinctively tree-frequenting insects, and constitute one of the most destructive groups of woodland pests.

The oak pruner (*Elaphidion villosum*) is one of the most common species; it attacks a great variety of trees but its work is especially conspicuous on oaks. In infested forests severed twigs and branches litter the ground so that in some cases literally carloads of them could be gathered. In Massachusetts Mr. F. H. Mosher recorded (in Kirkland, '97, p. 35) the Downy Woodpecker, Blue Jay, and Chickadee as enemies of the oak pruner, and the Biological Survey has found this species in stomachs of the Red-eyed and Yellow-throated Vireos. Beetles of the same genus are known to be eaten by the Screech Owl, Nighthawk, Red-headed Woodpecker, and Great Crested Flycatcher, also, and there is no doubt that these species feed likewise upon the oak pruner itself.

A handsome yellow-and-black banded species is the maple borer (*Plagionotus speciosus*) and the sugar maple has no more serious insect enemy than this borer. Not only does it attack and damage trees in their prime, but its operations open the way for the *Tremex* borer which comes in and extends the injury. Kirkland reports that he has seen "the Hairy Woodpecker, Downy Woodpecker, and the Flicker feeding upon white larvae taken from beneath the bark of maples infested by this borer,—presumptive evidence that these birds feed upon this insect." ('97, p. 32.)

The pine sawyers, including several species of the genus *Monochamus*, feed in dying and dead trees, and in logs, materially reducing the market value of the timber. These insects attract popular attention not only because of the large size and striking appearance of the adults, but also because the gnawing of the larvae although the latter are deeply buried in their tunnels in the wood, is often clearly audible, a fact that suggested the name sawyers. An interesting account of the white-spotted sawyer published as long ago as 1850 mentions three species of birds as its enemies. In their

work on Lake Superior, Professor Louis Agassiz and Doctor J. Elliot Cabot, mention that "The pitch-pine woods behind the post had been burnt over, and the trees, though yet standing were mostly dead, affording food for myriads of wood beetles (*Monochamus scutellaris*) whose creaking resounded on all sides. These in their turn were fed upon by the Canada jays and by two rare species of woodpeckers (*P. [icoides] arcticus* and *P. hirsutus*)." ('50, p. 72.) The Biological Survey has found remains of this same sawyer in stomachs of the Crow, Raven, Pigeon Hawk, Starling, and Kingbird. Other species of sawyers are known to be eaten by the Great Horned Owl, Nighthawk, Blue Jay, and Great Crested Flycatcher.

Some brightly colored longicorns of the genus *Cyllene* are common in New York; the adults of one of them being commonly seen on flowers of goldenrod. The larvae of these beetles bore in hickory and locust, almost every tree of the latter species being damaged by them. However, in this case also, we have bird allies, and the following New York birds are known to feed on members of the genus *Cyllene*: Hairy Woodpecker, Kingbird, Meadowlark, and Rose-breasted Grosbeak.

The ribbed pine-borer (*Rhagium lineatum*) attacks pines of various species, that have been injured by fire or other agency, and does material damage by hastening the death of such trees. The Biological Survey has found these beetles in stomachs of the Downy and Arctic Three-toed Woodpeckers, Blue Jay, and Nighthawk; and Mr. Walter N. Hess in a special bulletin devoted to the ribbed pine borer says that birds, chiefly the woodpeckers, are probably the most important of the predatory enemies of the insect. ('20, p. 79.)

A group of round-headed borers which live exclusively in the roots of trees is the genus *Prionus*. These are among the largest beetles in the United States, and their correspondingly large larvae bore the roots of oak, linden, poplar, chestnut, pine, cherry, etc., sometimes to such an extent as to injure or kill the trees. The beetles being so large it is natural that their bird enemies should be among the larger species, so we find the hawks and owls well represented. The list so far known includes: the Broad-winged and Sparrow Hawks, the Great Horned, Barred, Short-eared, and Long-eared Owls, the Red-headed Woodpecker, Blue Jay, Crow Blackbird, and Butcher-bird.

Prettily banded long-horns which are frequently seen in numbers on recently cut logs, are the yellow and black *Xylotrechus colonus*. This species feeds in hickory, oak, sugar maple, elm, ash, and other trees and is one of the most common members of the family. It

has been found in stomachs of the Raven (no fewer than 168 specimens), Nighthawk, and White-eyed Vireo, and closely related if not the same species, in those of the Solitary and Red-eyed Vireos.

Among the genera of round-headed borers most numerous in species is *Saperda* which includes species as noteworthy for their beauty as adults, as for their destructiveness as larvae. Poplars rarely attain any size in New York without showing the operations of one of these insects, the poplar borer (*Saperda calcarata*) and they are often severely damaged. Bird friends of the poplar, in that they are known to feed upon this borer, include the Pigeon Hawk, Blue Jay, and Robin. The elm borer (*Saperda tridentata*) which is very destructive to the ordinary or white elm is known to be eaten by the Red-headed Woodpecker and Red-eyed Vireo; the hickory borer (*S. lateralis*) by the Red-eyed Vireo; and of the thorn borer (*S. fayi*) Dr. Felt says: "Infested limbs are frequently investigated by woodpeckers and undoubtedly many larvae perish owing to the activity of these beneficial birds" ('05, p. 284).

The round-headed apple borer (*S. candida*) deserves more extended notice, not only because it is destructive to a cultivated tree but also because its natural enemies are better known. This species lives in the service berry or shad-bushes for a native food plant, and is a notorious pest in apple orchards. Mr. Fred E. Brooks says that it is the most destructive in the eastern United States of any of the several kinds of insects that injure apple trees by boring into the bark and wood. Birds are the only important enemies, and the author states that "woodpeckers destroy great numbers of the borers by removing them from their burrows . . . In some cases from 50 to 75 per cent of the borers are destroyed in this way. . . Probably both the Hairy and Downy Woodpeckers feed on the borers." ('19, p. 12.) It should be noted also that Mary Treat has definitely recorded that the Downy Woodpecker and Flicker feed upon this pest. ('93, p. 17.) It is entirely justifiable to add that if woodpeckers destroy 50 to 75 per cent of the borers in apple trees, they probably often do as well in woodland trees. That this is an immense service to woodlot owners need hardly be emphasized. Woodpeckers, as we have seen, are by no means the only bird enemies of wood borers; in fact more than 140 species of birds are known to feed either on the adults or larvae of these pests, and we may be sure that their services at times are of great value in checking the numbers of these important woodland pests.

WEEVILS: BELIDAE, BRENTHIDAE, CURCULIONIDAE

The weevils or snout-beetles are a numerous tribe of vegetarian insects which include among their ranks many notable pests. Many of them are enemies of the forest but only the best known New York groups and their bird enemies will be briefly treated here. The so-called New York weevil (*Ithycerus noveboracensis*) eats the buds and tender shoots of oak, hickory, and beech, causing many of the twigs and small branches to break and fall. It is a handsome weevil, larger than the average, and is known to be preyed upon by the Yellow-billed and Black-billed Cuckoos, the Blue Jay, Red-eyed Vireo, and Catbird. Seven individuals were taken at one meal by a Blue Jay which species seems to be the New York weevil's most important bird foe.

A slender weevil (*Eupsalis minuta*) of peculiar habits which feeds in recently dead and dying trees, preferably oak, excavating extensive galleries in the solid wood, is preyed upon by a number of New York birds. The Nighthawk, Red-headed Woodpecker, Crow, Blue Jay, Crow Blackbird, Baltimore Oriole, Rose-breasted Grosbeak, Brown Thrasher, Brown Creeper, and Wood Thrush are the birds now known to feed upon this oak weevil.

Nut weevils, the white grubs of which everyone has seen in chestnuts, and which attack also other kinds of nuts and acorns, are a factor in cutting down forest reproduction. The genus *Conotrachelus* includes such pests as the plum curculio, and the walnut weevil. These beetles are known to be eaten by 34 kinds of birds, the most prominent of which in New York are the Chimney Swift, Rose-breasted Grosbeak, the small flycatchers, and the vireos and thrushes. The chestnut, chinquapin, and acorn weevils belong to a long-snouted race (*Balaninus*), the beak in some of the species being longer than the remainder of the insect. They are so numerous at times that 2 or 3 of the larvae will be found in a single nut, and fully half of the entire crop is infested. However, they have numerous bird enemies, 84 kinds now being known to devour them. The New York birds eating them most extensively are the Nighthawk (13 being the largest number of these weevils found in a single stomach of this bird), Red-headed Woodpecker, Yellow-bellied Flycatcher, Great Crested Flycatcher, Wood Pewee, Baltimore Oriole, Chewink, Scarlet Tanager (20), Solitary (11), Yellow-throated, and Red-eyed Vireos, Purple Martin, and Eave and Tree Swallows.

The mottled willow borer (*Cryptorhynchus lapathi*), an imported insect, is a great pest to willows and poplars. So far this weevil has been found in the stomach of only the Wood Pewee, but other

species of the same genus which are also injurious are consumed by a variety of birds, and it is natural to suppose that the willow borer itself is not so overlooked as present data, literally taken, would indicate. Species of *Cryptorhynchus* are known to be eaten by the following land birds of New York: Downy Woodpecker, Chimney Swift, Nighthawk, Blue Jay, Starling, Red-winged Blackbird, Least, Acadian, and Yellow-bellied Flycatchers, Bank Swallow, White-eyed Vireo, Carolina Wren, and the Olive-backed, Gray-cheeked, and Hermit Thrushes.

Grubs of the sapwood borer (*Hylobius pales*) mine under the bark, and in the sapwood of white pine and other coniferous trees, and sometimes become quite destructive. According to Hopkins, woodpeckers are the principal enemies of this pest and the trees that are infested "are readily distinguished from those that are not, by the numerous holes in the bark and wood made by the birds searching for the grubs" ('99, p. 242). The Biological Survey has found sapwood borers in stomachs of the following land birds that inhabit New York: Screech Owl, Red-bellied and Red-headed Woodpeckers, Chimney Swift, Nighthawk, Crow, Blue Jay, Kingbird, White-crowned Sparrow, Rose-breasted Grosbeak, and Gray-cheeked Thrush. Of these the Nighthawk has the best record.

The white pine weevil (*Pissodes strobi*) is one of the commonest enemies of the white pine in New York State. It attacks and kills the terminal shoots, thus causing lateral branches to develop and entirely preventing development of the normal straight trunk necessary for a tree of commercial value. Dr. Hopkins notes that woodpeckers "feed on the matured larvae, pupae, and adults" ('07, p. 7) of the white pine weevil, and "Dr. Fitch has stated that after the infested shoot becomes withered and dry in midsummer one may observe that the bark covering the cells has been broken and peeled off in spots and that all its lower parts are torn away. Newly perforated holes larger than the burrows of this insect may be observed, here and there, in the wood. These he states, are the work of small birds which are very efficient in devouring the larvae and the pupae of this pest." (Felt, '05, p. 400.) The Biological Survey has records of the Yellow-billed Cuckoo, English Sparrow, and Bluebird feeding upon this pest.

BARK BEETLES: SCOLYTIDAE

Bark beetles are the most destructive enemies of coniferous trees; in some regions they do as much damage as forest fires and at times they have killed every tree of certain species over vast areas. Numer-

ous species of bark beetles inhabit New York State and a goodly proportion of them have done conspicuous damage. The hickory bark borer (*Scolytus quadrispinosus*) is seriously destructive to hickories and sometimes kills all of these trees on considerable areas. This insect is not without its bird enemies, however, and we know the identity of four of them, namely the Nighthawk, Chimney Swift, Wood Pewee, and Red-eyed Vireo. A near relative of the hickory bark borer which attacks wild cherry but is better known as a pest of various cultivated trees is the fruit bark beetle (*Scolytus rugulosus*). F. M. Webster noted in Ohio that birds had torn off all the bark of infested branches in order to get the larvae ('96, p. 26). E. P. Felt states that in New York "Woodpeckers are very efficient natural enemies and do much toward keeping this species and its allies in check." ('05, p. 453.) In Pennsylvania J. Warren Jacobs found numerous remains of the fruit tree bark beetle in the compartments of Purple Martin houses where the parents had been feeding them to the young ('12, pp. 108-9). Other birds that occur in New York that are known to feed on bark beetles allied to the aforementioned pests, i. e., members of the genus *Scolytus*, are the Acadian and Traill's Flycatchers, and the Olive-backed Thrush.

We know something of the bird enemies of three species of another genus of bark beetle that are destructive in New York. They are members of the genus *Ips* (formerly called *Tomicus*) which are known as engraver beetles from the striking appearance of the galleries they groove out under the bark. *Ips cacographus* works on pines, sometimes attacking living trees. It has been identified in stomachs of the Nighthawk (no fewer than 35 specimens found in one), Chimney Swift (11), Wood Pewee, and the Barn and Rough-winged Swallows. *Ips calligraphus* is one of the commonest bark beetles and seems to be an active factor in causing serious injuries to pines. It is known to be eaten by the same birds mentioned in connection with the preceding species and also by the Arctic Three-toed Woodpecker, the Purple Martin, and Bank Swallow. *Ips pini*, a special enemy of white pine, many of which it kills, and a foe of larches and spruces as well, has been found in stomachs of the same birds as has *cacographus*, and in addition in those of the Tree, Eave, and Bank Swallows, and the Solitary, White-eyed, and Red-eyed Vireos.

The apple bark beetle (*Monarthrum mali*) which feeds also in beech, spruce and other trees, is known to be eaten by the Chimney Swift, Nighthawk, and Veery; the elm bark beetle (*Hylesinus*

opaculus) by the Nighthawk and Bluebird; and the spruce bark beetle (*Polygraphus rufipennis*) by the Hairy Woodpecker. Seventeen specimens of the last-named beetle were found in a single stomach of this woodpecker.

The most pernicious tree enemies among all the bark beetles are those of the genus *Dendroctonus* which freely attack living healthy trees, and kill them sometimes in tremendous numbers. A species of *Dendroctonus* usually of secondary importance but which has been the primary cause of death of pine timber on Long Island is the black turpentine beetle (*D. terebrans*). It is known to be preyed upon by the Chimney Swift, Nighthawk, and Hermit Thrush. The spruce-destroying beetle (*Dendroctonus piceaperda*) is an exceedingly destructive species sometimes killing from 50 to 90 per cent of the spruce over great areas. Dr. A. D. Hopkins, who made a special study of the ravages of this beetle in the Northeastern States, concluded that "woodpeckers are the most important enemies of the bark beetle, and appear to be of inestimable value to the spruce-timber interests of the Northeast. Indeed I feel confident," he says, "that in the many hundreds of infested trees examined, at least one-half of the beetles and their young had been destroyed by the birds, and in many cases it was evident that even a greater proportion had perished from this cause alone." ('01, p. 25.)

Dr. Hopkins and other authors especially mention the woodpeckers as enemies of bark beetles and there is no doubt that these birds are important, probably the most important, avian foes of these beetles. The chief reason the names of woodpeckers do not appear more often in the foregoing lists of birds quoted from Biological Survey records probably is that the woodpeckers get more of the larvae of these beetles which are less readily identified than the adults. More than 50 species of birds altogether are known to prey upon bark beetles and the list includes nearly all of the birds that catch their food on the wing. The Nighthawk, Chimney Swift, and swallows deserve special mention in this regard; and it appears that whenever they encounter bark beetles on the wing that they very effectively supplement the suppressive tendencies of the birds that catch them about, or dig them out of, trees.

A tribute to the efficiency of birds as enemies of bark beetles is given by Messrs. M. W. Blackman and Harry H. Stage of the State College of Forestry in their account of insects affecting the larch in Erie County, N. Y., as follows:

"The work of woodpeckers is much in evidence and seems to be an efficient agency in reducing to some extent the numbers of the brood of several of the more numerous bark-boring insects. The

birds seem to work in two ways—first by making small conical holes through the bark into the sapwood to obtain the larvae of the larger species of beetles which have gone there to hibernate or to pupate, and secondly by removing practically all of the bark on large areas of the trunk to uncover the brood (larvae, pupae and young adults) of the bark beetles.

“In some cases this work reached an unusual degree of efficiency. For instance one particular tree forty or fifty feet high and about 14 inches in diameter, had had nearly all the bark removed from the ground to the very tip. This tree had been heavily infested with *Dendroctonus simplex*, *Polygraphus rufipennis* and other borers, but only a small per cent of the original infestation had survived the woodpecker's thorough search for food. Of course all of the infested trees had not been so thoroughly gone over by the birds and a number of such trees had apparently not been found by them at all. However, it is safe to say that the woodpeckers were an efficient force, working toward the return of the normal balance of nature which had been upset by the breeding of certain species of insects above the danger level, due to the girdling, season after season, of a number of the larches by farmers. It is not believed that the woodpeckers will be able unaided to reduce the numbers below the danger level, as long as more trees are girdled each year, but should this practice cease it is possible that they would be able eventually to obtain the upper hand and that conditions would return to normal.” (’18, pp. 16-17.)

CATERPILLARS: LEPIDOPTERA

Caterpillars, the adults of which are variously known as butterflies, skippers, millers, and moths are voracious feeders on green stuff, which include in their number many of our worst tree pests. Only one of the species notably destructive in New York is the larva of a butterfly, and that is the spiny elm caterpillar (*Eucnassa antiopa*). It feeds especially on the elm but occasionally has been known to strip acres of poplars. The caterpillars of this species are eaten by the Baltimore Oriole, and by the Yellow-billed and Black-billed Cuckoo. No fewer than 18 of the larvae were found in a stomach of the last named bird. The adults or butterflies, which are known to collectors as the ‘mourning cloak,’ have been found to the number of 9, in each case, in stomachs of the Cooper's and Pigeon Hawks.

Turning to the caterpillars which develop into moths we may notice one of the so-called American silkworms (*Samia cecropia*), a larva so large, that in great numbers it would be a serious menace



Fig. 19. Chickadee.



to woodlands. This caterpillar is a general feeder on deciduous trees, but evidently it is usually kept in check by its enemies since it rarely becomes destructive. The Downy and Hairy Woodpeckers are known to feed upon the cocoons of this insect, and the late Professor F. M. Webster found that only 2 out of a total of more than 20 cocoons in a small grove in Illinois had escaped destruction by the Hairy Woodpecker ('81, pp. 241-2). From observations made by himself and others in Nova Scotia, Dr. John D. Tothill concludes that nearly three-fourths of the caterpillars are eaten by birds (Orioles, Robins, etc), and about 85 per cent of the pupae are destroyed by woodpeckers. ('21, pp. 30, 36.)

When Leopold Trouvelot was experimenting with the related large caterpillar (*Telea polyphemus*) as a possible source of commercial silk, he found birds to be the most formidable enemies of the larvae, and he says: "It is probable that ninety-five out of a hundred worms become the prey of these feathered insect hunters" ('67, p. 89). In one case, to test the birds, he placed 2000 of the larvae on a tree near his door, and in a few days the birds had eaten all of them.

The green-striped maple worm (*Anisota rubicunda*) is a caterpillar which often defoliates maples, attacking both the hard and soft maples and box elders as well; in the absence of these favorite food plants it will turn its attention to other deciduous trees, especially oaks. This caterpillar is eaten by a number of birds of which the Robin and Yellow-billed Cuckoo were noted by Prof. Lawrence Bruner attacking the "worms" throughout a severe infestation at Lincoln, Nebraska. ('90, pp. 54-59.) The Bluebird, Tufted Titmouse, Red-headed Woodpecker, Red-eyed Vireo, and Crow Blackbird are also stated by the late Prof. F. H. Snow ('83, p. 96) to eat the caterpillars. To these species may be added from Biological Survey records the Blue Jay, Great Crested Flycatcher, and Black-billed Cuckoo. Fifteen of the larvae were found in a single stomach of the last named bird.

A close relative of the maple worm, the yellow-striped oak caterpillar (*Anisota senatoria*), feeds chiefly on scrub oak, but occasionally attacks and defoliates other oaks. Professor A. J. Cook has recorded the Robin and Blue Jay as feeding on this caterpillar and the Biological Survey has found it in stomachs of the Black-billed and Yellow-billed Cuckoos, to the number of 17 in one stomach of the latter species.

The fall webworm (*Hyphantria textor*) so-called to distinguish it from the common tent caterpillar, a spring form, feeds on leaves

of a great variety of trees and shrubs. The webworm often is numerous enough to be a nuisance and sometimes becomes so abundant as to rank as a major pest in woodlands. Biological Survey records show that the Yellow-billed Cuckoo, Baltimore Oriole, and English Sparrow feed on the webworm, and the Black-billed Cuckoo, Screech Owl, and Red-eyed Vireo have been otherwise recorded as its foes. Dr. John D. Tothill, who has done much careful work on the natural control of the fall webworm, gives in a recent comprehensive report the results of eight years' study of the species in New Brunswick, and of shorter periods in Nova Scotia and British Columbia. Careful account was kept each year of the percentage of destruction of the pest by various agencies, and it was found that Red-eyed Vireos destroyed from 11.4 to 89.5 per cent of the broods, averaging more than 68 per cent, far more, of course than any other agency. As a test case 382 caterpillars were placed on a tree and in 9 days the birds had taken all but 6 that had been parasitized. The work of the birds naturally was most effective when the webworm was scarce and in some years it seemed that scarcely a worm escaped the vireos. The insect seemed clearly doomed to local extinction when a flight of adult moths from a distance repopulated the district. In summing up his observation Dr. Tothill refers to the "tremendously important part played by the vireos in Eastern Canada, and by undetermined birds in British Columbia," and concludes: "They are of least importance when the host insect is very abundant; of greatest importance when the webs are very scarce; and they share with the parasites the task of maintaining a stabilized control when the insect is just moderately abundant. Without the birds, the parasites would not maintain a control . . . and the converse is also true." ('22, p. 34.) With their record of destroying 68 per cent of the broods, on the average, however, there is no question that birds take first rank as natural enemies of this pest.

The green fruit worm (*Xylina antennata*) has proved a pest to various orchard trees, and has also extensively defoliated soft maples. This caterpillar is a favorite with birds and Dr. Felt, State Entomologist of New York, has given a good account of their behavior toward it during a destructive infestation. "Last season" (1911), he says, "numerous birds, sparrows, and robins in particular, were observed at Amsterdam here and there upon the ground searching out and devouring the pests. One greedy robin was seen with three green fruit worms in his mouth. The birds were much more numerous among and under the infested trees than in other

portions of the city. Only a relatively slight increase in their number would probably have checked the pest before the trees were defoliated. Dr. W. G. Van Name, Zoologist of the State Museum, visited Amsterdam June 10th and made the following observations:

"The green maple worms were then already much reduced in numbers, and it was evident that if the rate at which they were being destroyed by birds should continue, few would be able to transform to the pupal stage. Nine species of birds were actually seen eating or carrying away caterpillars, and nine others were apparently associated in this work. Considering the number of individuals, size and habits of each of the species seen eating worms, the following were apparently most destructive and in about the order named: English sparrow, robin, crow blackbird, Baltimore oriole, cowbird, catbird, chipping sparrow.

"The English sparrow takes first place solely on account of its superior numbers; the robin, catbird, crow blackbird and oriole are individually more efficient. The cedar waxwing and yellow warbler were also seen carrying off caterpillars.

"The following species, seen about or under the infested trees, were doubtless there for the purpose of feeding upon the pests: bluebird, rose-breasted grosbeak, red-eyed vireo, warbling vireo, bobolink, redstart, song sparrow. The kingbird and phoebe were also seen, and though they feed chiefly on flying insects, appear to take some of the caterpillars, though this could not be established with certainty.

"The majority of the above-named birds had nests within two or three hundred yards of the infested trees and could be seen carrying off the caterpillars (the robins and blackbirds often with two or three at a time) to feed their young. The caterpillars were evidently a great attraction to the birds, since there were at least two or three times as many birds as in apparently equally favorable though uninfested localities." ('12, pp. 50-51.)

Caterpillars of the genus *Datana* also are known to have effective bird enemies. The yellow-necked apple-worm (*D. ministra*), a general feeder on deciduous trees, is preyed upon by the Brown Thrasher, Blue Jay, and Yellow-billed Cuckoos. Maxima of 28 and 67 of the larvae have been found in stomachs of the last two birds, respectively. The black walnut caterpillar (*D. integerrima*) frequently defoliates to a considerable extent or even entirely, trees of walnut and butternut. However, it is sometimes caught in the act by birds as in a case observed by Robert Ridgway, our leading ornithologist. Mr. Ridgway gives the following account (in a letter)

of the extirpation of a colony of these caterpillars which was attacking a black walnut tree at his former home in Brookland, District of Columbia:

"We first noticed the caterpillars something like two weeks ago, our attention being attracted to them by noticing several branches which had been stripped of their leaves. We then discovered the caterpillars in clusters on the twigs and foliage, and a little later a compact mass of them, about a foot long by 6 inches wide, on the bark of the trunk, a foot or so from the ground. Within a day or two of our first discovery of the pests we saw a yellow-billed cuckoo in the tree busily engaged in eating the caterpillars. Later this was joined by another (probably the mate), which, however, only made occasional visits to the tree, its time being doubtless mainly occupied with incubating or brooding. The other cuckoo practically *lived* in the tree, being very seldom absent, even for a short time, and was so persistent in destruction of the caterpillars that whenever one fell to the ground he would immediately follow it and then dispatch and devour it; and later, when few were left on the tree, we saw him carefully searching the ground beneath. The results of the work of these two cuckoos (principally one of them) was that within a week the colony of caterpillars was absolutely exterminated, and I have not been able to find one in the neighborhood." (July 30, 1906.)

The striped hickory caterpillar (*Datana angusii*) which feeds also on walnut and birch was observed by E. V. Wilcox to be eaten by the Red-headed Woodpecker, both species of cuckoos and the Blue Jay in Ohio, where he reported that "the birds help materially to maintain an equilibrium in the numbers of the pest." ('91, p. 61.)

Caterpillars with contrasting colors, as yellow and black, are supposed by theorists to taste bad and to be protected from birds. This remark is made now, not that it does not apply to *Datana* and other caterpillars previously mentioned, but that it serves to introduce an account of another larva in relation to which a special point has been made of the argument. The red-humped oak caterpillar (*Symmerista albifrons*), a yellow, black, and reddish-brown worm is one of these supposedly warningly-colored species, and it sometimes defoliates trees over large areas. However, the birds do not overlook it, as the Biological Survey has found that the Broad-winged Hawk (11 larvae in a single stomach), Yellow-billed Cuckoo (25), Black-billed Cuckoo (12), and Olive-backed Thrush feed on the red-hump.*

* Due to the use of cards misplaced in an index file these records were erroneously attributed to the red-humped apple-worm (*Schizura concinna*) by the writer in The Auk, vol. 40, no. 3, July, 1923, p. 560.

Hairy caterpillars also were long thought to be especially protected from birds, but this idea has proved to have little basis in fact. Certainly 50 or more species of birds feed on hairy caterpillars and they include in their prey some of the very hairiest of all. One of these, the gipsy caterpillar (*Porthetria dispar*), long a prime pest in Massachusetts, has spread to the eastern border of New York State. The larva of the gipsy moth is regarded as a much worse enemy of forests than is the tent caterpillar. It attacks all deciduous plants and will feed on evergreens when necessary. Millions of dollars have been spent in fighting it in Massachusetts but the insect has continued to spread and to devastate the forest. Birds have aided in the warfare against the gipsy moth and although unable to stop its advance, they should be given credit for their efforts. Forty-six kinds of birds are known to feed upon the pest, of which the most useful are the two cuckoos, the Baltimore Oriole, Catbird, Chickadee, Blue Jay, Chipping Sparrow, Robin, Red-eyed and Yellow-throated Vireos, and the Crow.

Another very hairy larva is that of the tussock moth (*Hemerocampa leucostigma*). This is a general feeder, usually noticed as a shade tree pest, and the fact that it does most damage in cities is an indication that in the country, under more normal conditions its natural enemies hold it in check. This point has received some attention from scientists and is referred to by Mr. Alan G. Dustan in a summary of an interesting study of the natural control of this pest in New Brunswick. He says:

"Investigations carried over a period of two years have shown that in cities the insect is controlled chiefly by three factors: non-hatch of eggs, starvation of the larvae hatching from eggs laid on buildings, and insect parasites. In the forest, however, a totally different condition exists, and there we find that birds and ants are responsible for holding the insect at par and preventing it from reaching a state of outbreak." ('22, p. 109.)

Although this writer did not observe birds preying upon the tussock moth in cities the present author has observed Robins feeding freely upon the larvae in Washington, D. C. Mr. Dustan reports that in the forest "practically every egg-mass laid above the snow-line (and over ninety per cent of them are) had been either partially or wholly destroyed by birds." (p. 119.) Observation of the kinds of forest birds feeding on larvae proved impossible, but by exposing larvae where they would be accessible to birds and apparently to no other enemies it was found that the supplies regularly disappeared, sometimes at the rate of 25 to 30 caterpillars a day.

Birds are credited with destroying half of the larvae hatching in forests.

In the United States twelve species of birds are now known to feed upon one stage or another of the tussock moth, and these are in addition to such groups as the titmice and allied small birds that must be chiefly concerned in the extensive destruction of the eggs of the insect pointed out by Mr. Dustan. The list of bird foes of the tussock moth as at present known includes the Hairy Woodpecker, Yellow-billed Cuckoo, Black-billed Cuckoo, Whip-poor-will, Chimney Swift, Phoebe, Wood Pewee, Crow, Blue Jay, Baltimore Oriole, English Sparrow, and Robin. As many as 41 and 50 tussock caterpillars have been found in single stomachs of the Yellow-billed Cuckoo, and according to Dr. E. Sterling of Cleveland, Ohio, "In the summer of 1880 the elms along Euclid Avenue, especially in my vicinity, were attacked by the 'New Haven elm-tree caterpillar.' Fearing a repetition of their trouble, numbers of us fought the cocoons in the fall and destroyed thousands, but when winter set in tens of thousands still remained on the outer branches beyond reach. About the first of December a pair of hairy woodpeckers (*Dryobates villosus*) made their appearance and fed daily on the grubs; in the course of that month and the next over a dozen of the birds were added to the number and by their industry on this particular pest attracted the attention of all who passed. Suffice it to say that when March came not a cocoon was to be seen in those places where the branches were literally white with them before, and more, this is the last we ever saw of the New Haven visitor." ('91, p. 295.)

It is not always that birds succeed in locally exterminating an insect pest, yet they are known to have done so in so large a number of instances as to prove that it is a frequent happening. One insect known to have often been extirpated locally by birds is the tent caterpillar (*Malacosoma americana*). This worm feeds most commonly on wild cherry, its tents being a regular feature in such trees in early spring; frequently the larvae feed so persistently on the new leaves and even on the buds that the trees remain quite bare until the caterpillars have completed their growth. The tent caterpillar attacks numerous other deciduous trees also, sometimes becoming highly injurious in orchards. Forty-five kinds of birds are known to feed on tent caterpillars or their eggs. The titmice and chickadees eat the latter most frequently perhaps, but individual stomachs of Blue Jays have yielded great numbers of them, 845 and

1047 in two instances. The cuckoos take larger numbers of the larvae than other birds, attaining to 200 for a single meal. The work of these birds on the tent caterpillar is so effective that it has many times been observed to result in local extermination. Blue Jays, Orioles, and Cedar-birds also have been observed to render the same service.

A closely related caterpillar (*Malacosoma disstria*) is called the forest tent caterpillar although it does not make a tent. This worm varies greatly in abundance but sometimes becomes so numerous as to ravage both orchards and woodlands. It is a special pest of the maple and its attacks result in decreased yields of sap and sugar. However, man does not lack feathered friends to help him fight this foe. Thirty-six species are already on the list and future observations undoubtedly will add to them. Some of the most interesting observations of the bird enemies were made by Miss Caroline G. Soule, who gives a partial account of them in a letter of April 7, 1915. "Some years ago I worked as Entomologist through three seasons of serious infestation by forest tent-caterpillars in a small Vermont town, and my daily, even hourly, watching of the birds which ate, or fed their young, any stage of that pest, enabled me to add a few facts in favor of the Baltimore oriole, which not only devoured larvae in all stages, and moths, but wholly cleared many trees of the pupae, ripping the cocoons so fast that the young were given hundreds of pupae in a day. The redwing blackbirds were a good second and cleared low trees and shrubs. Chebecs, wood pewees, and phoebes snapped up the larvae which were falling by threads, and ate the moths which fly before dark. Cuckoos and downy woodpeckers did their share and nuthatches ate larvae by scores." Other notes from Miss Soule's observations have been published by Prof. C. M. Weed. "Miss Soule observed robins, orioles, chipping sparrows, catbirds, cuckoos, the red-eyed, white-eyed, and warbling vireos, cedar-birds, and nuthatches feeding on the caterpillars. The nuthatches, according to Miss Soule's account, 'would stand by a patch of larvae lying close together below a tar band on a tree and eat so voraciously and with such an entire abandonment of self-consciousness that I could go close and put my hand on them before they would fly. This experience was repeated several times.' The cocoons were attacked by chickadees . . . as well as by nuthatches. The moths also were eaten in great numbers by many sorts of birds, including robins, chipping sparrows, yellow-birds, and even English sparrows." ('99, pp. 91-92.)

Another lady observer, Mary B. Sherman, reports birds of great value in feeding on the forest tent caterpillar at Ogdensburg, N. Y. She wrote on May 18, 1900, that "the town is full of birds, and they are doing good work feeding on the forest tent-caterpillars. . . . The English sparrow has been eating the forest tent-caterpillars, and last summer they attacked the cocoons and fed on the moths. We have an unusual number of orioles, which I have seen feeding on the caterpillars. I have also seen the yellow and several other warblers, the yellow-billed cuckoo, the robin, the cedar-waxwing, and, I believe, the house wren feeding on the caterpillars. The maples in front of the house have been filled with warblers, all of which were very busy with the trunks and branches, and yesterday I noted five varieties."

On May 26 she states: "We have practically no forest tent-caterpillars in town. They hatched in large numbers, but the cold evidently killed many and the birds appeared to have cared for the remainder." ('01, p. 1019.)

Cankerworms (larvae of *Anisopteryx* and *Paleacrita*) are most injurious in the northern States, and they attack not only apple and pear trees as is so well and unfavorably known, but other deciduous trees, also, especially the elm. Cankerworms are small, smooth caterpillars of a type that almost all birds seem to relish, and they are known to be eaten by more than 75 species of birds. In a number of cases birds have been observed to clean up local infestations of these caterpillars. Walter H. Wellhouse, who made a special study of a cankerworm outbreak in Kansas, concluded that:

"Next to unfavorable weather, the birds are the most important natural enemies of the cankerworms. Probably no insect is a favorite food of more species of birds than the cankerworm larva. It lives exposed on the outside of twigs and leaves where the birds can easily secure it, and is without distasteful hairs or spines on its integument. The English sparrow, which is said to have been imported into America to check the ravages of this insect, is no doubt our most efficient cankerworm eater in the cities. We have watched these much-despised birds picking larvae from the elms at all hours of the day from early morning to twilight, and even during rains. The Robin is also an efficient destroyer of cankerworms, especially of the moths which are found at the base of the tree. The writer has seen flocks of Bronzed Grackles alight in the tall elms in Lawrence, and, moving from branch to branch, noisily devour great numbers of larvae. Having exhausted the supply on one tree they moved in concert to another tree to continue the feast.

"Many of the more timid birds which are not found in the cities so commonly as the English Sparrow and Robin are just as efficient enemies in the country.

"Mr. C. D. Bunker, curator of mammals in the Dyche Museum, secured a hundred birds from a grove four miles from Lawrence and carefully estimated the percentage of cankerworm larvae found in their stomachs. They were taken near the edge of the timber where they could easily have returned from the surrounding fields with other food, and the grove is composed of several species of trees, only a small per cent being elms infested with cankerworms." ('17, pp. 301-302.)

The hundred bird stomachs reported upon, represent 39 species of birds, all but three of which had eaten cankerworms. Eighteen of the species had at least one individual which had eaten 100 per cent cankerworms.

We see that the clearing up of local infestations of insects is by no means exceptional and incidents of the sort thus far mentioned are only a few out of many that could be cited. In much fewer instances an insect pest is controlled over a large area by the depredations of birds upon it. However, it does happen, and in illustration of the phenomenon the work of English Sparrows on the drop worm may be mentioned. This larva, another smooth caterpillar of the looper or measuring worm group, has for its adult stage the snow white linden moth (*Ennomos subsignarius*). Prior to 1870 this insect was a formidable pest of shade trees, especially in cities, but from 1907-1910 it again became abundant and seriously damaged forests in the Catskills and Adirondacks. Our native birds undoubtedly prey upon this insect, but the extent to which they do so is unknown. In the case of the English Sparrow, however, several observations have been made. A. R. Grote, a distinguished entomologist, said in 1883:

"Many will recollect that the maple and other shade trees in Brooklyn and New York used to be completely defoliated by the middle of summer by the common brown drop, or measuring worm. . . . The English Sparrow rid us of this nuisance; it ate every one of them." ('83, p. 235.)

John B. Smith, former State Entomologist of New Jersey, made the following interesting observations on the relations of the English Sparrow and this insect:

"On the evening of July 17 [1908], Newark, Elizabeth, Paterson, Jersey City, and some of the surrounding towns were treated to a

unique experience; a veritable swarm of snow-white moths flying around the electric lights and giving the appearance of a snowstorm in midsummer On the morning after the flight the sparrows apparently became very busy soon after daylight, and all that was left to mark it was numerous quantities of wings without bodies This flight was composed of individuals of the snow-white *Eugonia*, known everywhere half a century ago as the parent of the 'span worm.' It was at that time the most abundant and destructive shade-tree insect in the eastern United States, and its caterpillars, feeding upon most of the shade trees, were a nuisance by their habit of suspending themselves by threads from the foliage upon which they fed, and dropping upon pedestrians moving beneath.

"These caterpillars were responsible for the introduction of the English sparrows into this country. So abundant were they and so helpless were the authorities against them that the suggestion was made and favorably acted upon that this foreign bird be introduced for the specific purpose of dealing with the 'worms.' The sparrows did their work well. It was not long before the caterpillars practically disappeared from the cities." ('08, pp. 317-318.)

Glenn W. Herrick, in a bulletin of the Cornell University Experiment Station, sums up the evidence as follows:

"The testimony regarding the activity of the English sparrow in exterminating this pest in cities seems to show rather conclusively that this much disliked bird did actually bring about the destruction of this insect. Nearly every writer on the snow-white linden moth makes acknowledgment to the sparrow and declares that the cities owe their freedom from this insect to that bird." ('10, p. 62.)

The dropworm thus is suppressed in cities because a bird fitted to be an effective enemy is abundant there. The very converse of this situation is presented in the case of the carpenter worm (*Prioxystus robiniae*). This larva is a serious enemy of several of our native trees, as oak, maple, and locust, and was regarded by Dr. Fitch, first State Entomologist of New York, as the most pernicious of all wood borers as it makes so large a burrow by way of which water enters freely and rots the very heart of the tree. Nowadays the carpenter worm is regarded as a pest, however, only in cities where there are few or no woodpeckers to keep it in check. Entomologists have reported that the insect is rarely injurious where exposed to the attacks of these birds.

During most of their life history borers are little exposed to the attacks of other birds, but they are the natural prey of woodpeckers and it is well for man that these bird helpers are so consistently on

the job. Two additional kinds of borers that damage woodland trees are larvae of clear-winged moths. One of these (*Sesia acerni*) feeds in maple, and keeps open any wounds occurring in this tree, finally causing great disfigurement. At Buffalo it has been known to cause much damage to hard maples. According to Dr. Kellicott, woodpeckers are efficient aids in keeping this borer in check (Felt, '05, p. 58). The other clear-wing larva (*Sesia pictipes*), has more of a reputation as a fruit-tree pest but it attacks also wild cherry and junberry. At Albany Dr. James S. Bailey observed that an "infested tree was visited several times by the hairy woodpecker . . . and on each occasion it worked industriously for a considerable time exploring the bark in search of larvae and undoubtedly securing a number." (Felt, '05, p. 454.) The Wood Pewee, Kingbird, and Phoebe have been recorded as captors of the adult moths of this species.

Woodpeckers are most effective foes of another boring tree pest also, the pine-tip moth (*Pinipestis zimmermani*). This destructive borer attacks the slender growing tips of pines, sometimes killing a considerable number of them. It thus transforms healthy symmetrical trees into scrubs which are not worth the space they take up in a woodland. We have no observations on its bird enemies in the East, but the Hairy Woodpecker is highly praised for controlling it in the West. Mr. Josef Brunner, who studied the insect there, reports that:

"In most sections of the Rocky Mountains the Rocky Mountain hairy woodpecker (*Dryobates villosus monticola*) is unquestionably the most efficient natural force in restraining the Zimmerman pine moth. Thousands of trees are each year regularly infested by the moth in comparatively small areas, and this bird as regularly destroys almost all of the larvae in all of them during early winter, so that, although hundreds of trees may be examined at a time, it is only on rare occasions that larvae are found after December in wounds in the trunks of trees which had been infested during the previous summer. This woodpecker seems to have a decided preference for the caterpillar of the pine moth wherever the writer and the entomological rangers assigned to the Northern Rocky Mountain Field Station have had opportunities for observation. In the extreme southeastern part of Montana, and particularly that portion covered by the Northern Cheyenne Indian Reservation and by the Custer National Forest, the moth has apparently neither bird nor insect enemies. In all other localities this woodpecker is fully able to elim-

inate this insect as a serious factor in timber destruction. Especially will the work of the bird become effective when the habits of the moth are more generally understood and its 'brood trees' are eliminated through use by man." ('15, p. 6.) We may be sure that the Hairy and probably other species of woodpeckers are equally effective foes of the pine-tip borer in the East.

The spruce budworm (*Tortrix fumiferana*) is known from New York and has been characterized as the most destructive enemy of spruce in Maine. In New Brunswick, outbreaks of the spruce budworm of increasing frequency and seriousness culminated in one in which practically all fir of commercial size was killed and red spruce seriously damaged. Dr. J. D. Tothill, who carefully studied the progress of the latest infestation observed that "even in the most heavily infested parts of New Brunswick it soon became evident that there were natural checks operating against the budworm that sooner or later would bring it under control." At Fredericton in 1918 about 20 of the average laying of 150 eggs were eaten by birds. Together the various natural checks cut the numerical abundance in half. "In succeeding years, as the food pressure increased and the insects decreased, the birds and insect parasites became more important. The birds observed feeding on the larvae were: The white-throated sparrow, the song sparrow, the junco, the robin, the black and white warbler, and several undetermined species of warblers. . . . The outstanding fact concerning these natural checks is that at all places, such as Fredericton, where the favored food plant was present in abnormally large quantities, the natural checks were wholly incapable of suppressing the insect until it became practically starved out of existence.

"In marked contrast to the Fredericton conditions were those in Madawaska County and at Lillooet in British Columbia, where the favored food plants—balsam fir and Douglas fir, respectively—existed in smaller and more natural quantities." At Lillooet it was found that the eggs and pupae resulting from an average clutch of 150, fifty-eight were consumed by birds. "In this case," says Dr. Tothill, "the natural check brought about a reduction of the insect before any trees were killed and in the following year the outbreak subsided entirely, due to continued activity of the birds against the smaller number of larvae. Juncos were by far the most abundant of the birds, but others were—mountain chickadee, Western tree sparrow, Western robin, Western tanager, hermit thrush, Western evening grosbeak, bush-tit, pygmy nuthatch, red-breasted nuthatch, black phoebe, and Brewer sparrow." ('23, pp. 174-176.)



Fig. 21. Trees planted by birds. Red cedars along fence-rows.



Fig. 22. Nest box occupied by a Flicker.

Whether West or East, and almost regardless of the pest concerned, birds enter into the warfare against our insect foes. Another forest insect they relish, and like the last an enemy of evergreen trees is the larch case-bearer (*Coleophora laricella*). While this insect is not such a scourge as the larch sawfly, it kills some of the trees and is an ever-present drain on their vitality. Regarding it Mr. A. B. Baird says that in New Brunswick "Birds were among the chief factors in controlling this insect and the following species were noted: Song Sparrow, Chipping Sparrow, unidentified sparrow, Mourning Warbler, American Goldfinch. On May 18th in the woods at Fredericton large numbers of birds were seen feeding on the larvae; Song Sparrows and Chipping Sparrows were the most abundant. A large species of sparrow, which was not identified, was also present, and a few Mourning Warblers. These birds were all feeding very eagerly upon the case bearers and the snap of their bills was very noticeable on all sides as they hopped from branch to branch picking off the larvae. One Song Sparrow was seen with its beak packed with case bearers but all the others appeared to swallow them as they picked them from the trees. On May 20th, in the same place, birds were again noted feeding voraciously on the larvae, Chipping Sparrows being the most abundant species. In this particular area a very large percentage of the larvae had been eaten and on trees where there were from 2 to 5 or more case bearers in each leaf whorl, on May 10th, one could not find more than one case bearer in every 2 to 5 leaf whorls on the 18th. Birds were also seen feeding on the larvae at Chipman but not to the same extent and it is doubtful whether the birds were so abundant in most of the larger larch swamps; they were noticeably much more abundant around the edges of clearing and old pastures. The percentage taken in these places probably amounted to 75 per cent at least but in general about 25 per cent would probably be nearer the average." ('23, pp. 169-170.)

The alder borer (*Sthenopis argenteomaculatus*), also has no more important foes than birds, in this case the woodpeckers. Dr. D. S. Kellicott, who published information on this topic, expressed himself as astonished at the scores of the borers removed by these birds ('89, p. 251.)

SAWFLIES, BORER WASPS, AND ANTS: HYMENOPTERA

Not many Hymenoptera are enemies of trees and we know little of the bird foes of those that are. The larvae of sawflies resemble caterpillars in appearance and habits, and like them cause extensive defoliation of shrubs and trees. That of the larch sawfly (*Lygaeon-*

ematus erichsoni) has appeared at times in the northern States in immense numbers and eaten all the foliage of its host tree over many square miles. It has seriously injured larches in the Adirondack region. This sawfly occurs in England also and birds have been observed to be among its most important enemies there, so much so in fact that in one district numerous bird houses were erected with the result that larger numbers of birds were attracted there to feed on the pest. One of the important predators upon this larva in England is the Starling; the same bird is common in New York now and undoubtedly preys upon the same insect here. During an outbreak of the larch sawfly in Minnesota, Vernon Bailey of the Biological Survey observed the Black-billed Cuckoo and Red-eyed Vireo eagerly devouring the worms, and they have been identified in the stomach of a Philadelphia Vireo also. In New Brunswick Mr. A. B. Baird saw Vesper and Song Sparrows, Palm Warblers, and Black-capped Chickadees feeding on the larvae and gives birds credit for consuming about 10 per cent of them ('23, p. 162).

Some of the borers that are included in the order Hymenoptera are quite destructive. One known to science as *Tremex columba* is common in elms that have been weakened by attacks of the elm-leaf beetle, and also works in other injured or diseased trees. The adult of this pest is a large wasp-like insect, which is known to be eaten by the Kingbird, Wood Pewee, Blue Jay, and Solitary and Red-eyed Vireos.

Most ants are nuisances and some have quite injurious traits. The common large black species known as the carpenter ant (*Camponotus herculeanus*) hollows out trees already wounded or diseased, thus weakening them so that they fall in winds, and rendering them worthless except for firewood. Practically all birds eat ants, and the woodpeckers and thrushes among New York birds are especially fond of them. More than 50 kinds of birds prey upon carpenter ants, among which the following seem to take them most freely: Red-eyed Vireo, Starling, Crow Blackbird, Crow, Nighthawk (more than 100 in a single stomach), Ruffed Grouse, Flicker, and the Downy, Red-headed, and Pileated Woodpeckers. One of the last named birds had consumed 288 of these ants for its last meal. We may be sure at all times that birds are helping us fight our ant pests and helping very effectively as well.

ECONOMIC IMPORTANCE OF WOODLOT BIRDS

Protective value. We have seen that birds are a prime agency in reforestation (pp. 98, 101), that they do much to keep down the numbers of serious rodent enemies of trees (p. 101), and that they wage warfare on practically every insect foe of the forest (pp. 101-136). They may well be called health officers for our trees. Wherever unhealthy conditions prevail as a result of insect attacks, birds are sure to discover them and to do something toward improving the situation. As surgeons examine human bodies for evidences of disease and remove the cause, so birds tirelessly scan the trees from top to base, detecting insects and devouring them. As there are specialists among the surgeons, some paying particular attention to one part of the body and others to another, so with the birds in their relations to trees.

The ground feeding birds, as the Wild Turkey, grouse, Chewink, wrens, and thrushes, search the leaf-strewn forest floor (see Fig. 2) and devour many insects injurious to the trees. The woodpeckers clamber about over the trunks and larger branches, detect their prey beneath the bark and dig it out. The creepers and nuthatches frequent the same parts of trees, closely inspecting crevices in the bark, which may yield some insect tidbits. The titmice, chickadees, and kinglets choose for their hunting grounds the smaller branches, twigs and buds, where may be found the small insects and their eggs of which these little birds are so fond. The cuckoos, orioles, vireos, and warblers closely examine the leaves, and prey upon the larvae and sucking insects so abundant there. The hummingbirds, with some assistance from other small species, prey upon insects frequenting flowers. Moreover, the birds which feed upon or about trees are not the only ones that benefit them by devouring their insect foes. When these insects take to flight, they are likely to be snapped up by the flycatchers, and when, as frequently happens, they form large migratory swarms, they are preyed upon voraciously by the nighthawks, swifts, and swallows.

A large number of birds participate in the destruction of forest insects, and it is fortunate that this is the case, for the insect foes of trees are legion. More than 500 different kinds of insects are known to live upon a single species of tree, and the number of individuals of these pests that are sometimes present is practically infinite. Bark-infesting insects are among the most destructive enemies of the forest; they have been known to kill almost every tree of

certain species over hundreds of square miles. Wood borers hasten the decay and disintegration of trees and are especially injurious to shade trees; leaf-feeding insects frequently strip trees or make them appear as if scorched by fire, and, in some cases, have threatened to destroy all of the trees upon which they feed over vast areas. The total damage to trees by insect pests is enormous, and recently has been estimated to range between \$100,000,000 and \$150,000,000 annually. Not only is the damage extremely large, but the difficulties of directly combating insect pests in forests are so great that man is able to do comparatively little. The services of natural enemies of the destructive insects should therefore be highly appreciated. If they serve to reduce the damage by only a small percentage, the gain to the country is a very large sum. Among these enemies, birds are conspicuous and their services are well known and have long been acknowledged. No reasons have thus far developed for considering any other group of the natural enemies of forest insects in general, more important than birds.

A similar remark can truly be made on birds as foes of tree-destroying rodents, while as agents in reforestation birds are surpassed only by man.

Value of game birds. The Ruffed Grouse is the only game bird that really pertains to the woodlot in New York. Quail are denizens of more open country, as are the introduced Pheasants also, to a great extent. However, the Grouse is a valuable game species, one of the most valuable in fact, and if every sizable woodlot supported its proper quota of these birds, its earning powers would be definitely increased. Few birds are the object of keener search by sportsmen, and the visits of the hunters to well-stocked woodlots involve expenditures that add in various ways to the revenue of the entire neighborhood—to store-keepers, to managers of automobile service stations, and of boarding houses, and to the woodlot owner directly, if he exercises any of the functions just named, or leases the shooting rights. Under some conditions more revenue has been produced by maintaining a good stock of game, and catering to the needs of sportsmen, than could be brought in by agricultural and silvicultural operations in the district. While the woodlot owner may not find it desirable to adopt such a program in its entirety, he may profit by the knowledge that game birds, and the drawing power they have, can be made a source of income.

Recreational value. Any neighborhood that hopes for many summer boarders should realize that natural beauty is the most

powerful attraction possible. The lakes and streams and hills draw the vacationer, but only when they have a proper setting of trees; bald, they fail to please. Tree-fringed waters and wooded hills are natural, are beautiful, and attract. Groves and woodlots, with their verdure alone may be beautiful, but graced by flitting wings, and ringing with the song of birds, they are alive, irresistible. Alone they are like a painting, still, mayhap dull; with birds they are a moving picture. Birds supply the life and action that lure the visitor to return to scenes, which without them, would charm but once. Bird-filled woods are an asset, beyond a doubt. Where the vacationer has been pleased, he will return, will bring others with him, and recreational expenditures will increase; the region that has preserved its trees, and birds, and flowers, will reap its reward.

CONSERVATION OF WOODLOT BIRDS

General remarks on conservation of birds. In the United States the general proposition of bird conservation has no question marks attached to it. It is a profound conviction of the people, that has been written into a code of protective laws, both State and Federal, that is the best in the world. Originally the basis of much of this legislation was the demonstrated practical value of birds in controlling injurious insects, but later, widespread appreciation of the esthetic value of birds has developed into a bird protective sentiment that is one of the most powerful public movements of the time. Birds are then well protected by law and it is certain that they will continue to be protected. They have a fine public sentiment favoring them, but they still need the practical attention of human friends to special local needs for their welfare.

Methods of protecting and attracting birds. The fundamentals of helping birds are to protect them as thoroughly as possible, to see that they have a continuous supply of water, to provide nest boxes for the hole-nesting species (see Fig. 22), and when necessary, to supplement the natural food supply. As applied to woodlots, bird protective and attractive methods must be simplified. It is not feasible, as a rule, to adopt special protective measures, but vagrant cats can be eliminated from the farm, so far as possible, and occasionally a Sharp-skinned or Cooper's Hawk, or a red squirrel, can be done away with. However, the more thoroughly protective measures can be applied, the better will be the results.

Water supply, in the form of small streams, now is present in most New York woodlots; if not present, in most cases, it will probably

be impracticable to remedy the defect. If there is a water supply not far away, some birds no doubt will nest in the woodlot, but if there is none in easy flying range, the other woodland attractions will go for naught.

The provision of nest boxes is an obligation, nowadays, upon all who would help birds. No longer is there a profusion of decaying or dead trees containing cavities which formed the natural homes of a whole series of our most valuable birds. Unless nest boxes are provided for these species, all but the most expert drillers among the woodpeckers, and the few birds which fall heir to their abandoned nest-cavities, will become greatly reduced in numbers. These hole-inhabiting birds, as the Woodpeckers, Crested Flycatcher, Tree Swallow, House Wren, Nuthatches, Titmice, Chickadee, and Bluebird, are among the most valuable bird friends of the forest. Will we let them vanish for the lack of places to rear their young? The answer should be a hearty "No," and action to make good on that response should be taken in every woodlot. It is easy to put up bird boxes and they help just so much.

Publications on bird houses and other methods of attracting birds can be obtained from the United States Department of Agriculture, Washington, D. C., the Cornell Agricultural Experiment Station, Ithaca, N. Y., and the National Association of Audubon Societies, 1974 Broadway, New York City.

Besides the protection, water supply, and nest boxes mentioned in previous paragraphs, the food supply should receive some attention. It is easy for instance in clearing operations to spare a juneberry bush, here and there, or raspberry, blackberry, elder, or mulberry. The presence of their favorite wild fruits will induce more birds to nest in the woodlot and will help them with their food problems. If wild berries are not already present it would be well to plant some of the most favored kinds about the woodland margins. The names of these fruits and the seasons when they are in bearing, are given in the Federal Department of Agriculture bulletins previously mentioned.

When we plan to help the birds solve their food problems, we must bear in mind that winter is the time of greatest need. If we are to make but one effort in behalf of our bird friends it had best be winter feeding. The winter foods commonly used include suet or other fat, pork rinds, bones with shreds of meat, cooked meats, meal worms, cut-up apples, birdseed, buckwheat, crackers, crumbs, coconut meat, cracked corn, broken dog biscuits or other bread, hemp seed, millet, nut meats of all kinds (especially peanuts), whole or

rolled oats, peppers, popcorn, pumpkin or squash seeds, raw or boiled rice, sunflower seeds, and wheat.

The methods of making these supplies available to birds are as varied as the dietary itself. The devices most suitable for woodlot use are the so-called food-bells, and food houses, which will hold a considerable supply of food, and protect it absolutely from the weather. Another weather-proof device is a coconut with a hole bored in one end. The cavity is filled with chopped suet and nuts or other food mixture, and the nut is suspended by a wire from a limb. The size of the hole regulates the character of the guests; if small, large birds can not gobble the supply. The coconut meat as well as the stuffing is eaten. Cans with small openings may be substituted for coconuts. Food baskets of any desired size made of wire netting or a metal grating may be hung up or fastened to the trunk of a tree. Food mixtures in melted fat may be poured into holes made in a branch or stick or in cracks of bark or over ever-green branches. All of these devices minimize or obviate the disturbing effects of stormy weather.

More elaborate apparatus for the same purpose comprises forms of food-bells which are hung up in trees, and food houses. The food house is a permanent structure, with solid roof, and glass on one or more sides to permit observations. The food trays it contains are entirely sheltered from the weather. In one style this result is obtained by mounting the house on a pivot and furnishing it with vanes which if large enough keep the open side away from the wind.

Game birds and sparrows may be provided with feeding places by erecting low hutches or making wigwam-like shocks of corn or grain sheaves under which food may be scattered. The opening should be to the south. These shelters should be inspected about once a week to see that they are not covered or blocked with snow, and to renew the food supply.

In trimming operations it would be well also to allow for entertaining some of the seed-eating birds. Alders and birches bear in their numerous cones a supply of seeds which are eagerly sought for by Redpolls, Siskins, and Goldfinches during the winter. Still another group of birds are catered to by ashes and box elders. The winged fruits of these trees are opened and the seeds eaten by Pine and Evening Grosbeaks, the visits of these birds being largely regulated by the supply of this kind of food. Larches, pines, and other conifers are attractive to Crossbills as well as to some of the species just mentioned. Mixed plantations it seems are best for birds.

Woodlot policies in relation to birds. A fundamental of forest protection everywhere is prevention of fires. Fire not only directly kills trees and especially those of the younger generation, but it consumes the humus so necessary to healthy forest growth, and to water conservation, and it damages trees not killed by rendering them more subject to attacks of insects and to decay. Fires are to be prevented so far as possible, and this certainly is for the good of birds as well as of the trees. The cleaning out of old roads and trails as fire barriers and the breaking up of large woodlands into blocks by open fire lanes are measures recommended to minimize damage by fire, and all this encourages birds. Birds are much more numerous around the margins and in openings of woodlands (see Pl. 1 and Fig. 1) than in extended dense forests. Although it is contrary to general practice, foresters advise against grazing in woodlots. A closely pastured woodlot is recognizable at a glance; one can see clear through it under the trees; the ground is bare, puddled and hard, the undergrowth and limbs of the trees as high as the cattle can conveniently reach have been destroyed. The old trees are injured (stag-headed) by the compacting of the soil around their roots and by destruction of the humus layer, and reproduction is entirely prevented. Grazing and continuous forest reproduction (the latter a necessity for woodlots because of constant cutting) are incompatible. Again good woodlot policy benefits the birds, for to them the undergrowth (see Fig. 2) is of importance in furnishing nesting sites and food, and together with the leaf-mold, in maintaining a sufficient degree of humidity. Gradual cutting of woodlots is recommended as it interferes less with general conditions favorable to trees and always leaves some of the older seed-bearing individuals to provide for reproduction. This policy also is favorable to birds for it permits most of them to resort to the same area year after year instead of seeking new homes, and in general involves the least change in the essential conditions of the environment. Indeed we are justified in saying that practically everything that is good for the woodlot is good for birds.

SUMMARY AND RECOMMENDATIONS

One of the pressing needs of civilization today is assurance of a timber supply for the future. New York has about 12 million acres of forest land of which a third is on farms, in other words is woodlots. Woodlots therefore are a very important part of the forest resources of the State, and all factors influencing their welfare

should be given careful consideration. In previous pages it has been pointed out that: (1) birds are indispensable agents in the natural dissemination of trees reproducing themselves by fleshy fruits and nuts, and that they aid also in the reseeding of coniferous trees; (2) birds are the most important natural check on tree-destroying rodents; (3) birds are of great value in cutting down the numbers of an enormous variety of insect pests of the forest; (4) game birds of the woodlot are a source of increased revenue; and (5) bird life in general by making woodlands more attractive contributes to recreational values, both esthetic and material.

Evidently birds are a great asset to woodlots, and as such should be conserved. They can be protected, attracted to woodlots, and encouraged by simple and economical methods. Their care should be made a part of routine woodlot management. The constantly rising value of woodlots and their products fully justifies this care of birds especially since the activities of birds, for the most part, react so favorably upon the welfare of woodlands.

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CURRENT STATION NOTES

THE RELATION OF BIRDS TO WOODLOTS

The present number of the *Bulletin*, by Mr. W. L. McAtee, on the relation of birds to woodlots, was prepared for the Roosevelt Station by a special arrangement, and with the permission of his Chief, Dr. E. W. Nelson of the Bureau of Biological Survey, and of Secretary Jardine of the United States Department of Agriculture. We have long needed just such an authoritative summary of our knowledge on this subject, and we appreciate very much the co-operation of the United States Department of Agriculture in this matter.

In forestry the woodlot problem is a serious and important one, because of the vast acreage involved and because the woodlots are located largely in regions where wood is much needed. They are very commonly injured by the over-grazing of domestic animals. This is particularly liable to occur in the case of lands leased for short periods, when the tenant is not much interested in the upkeep of the woodlot, or when the owner is ignorant or negligent of his woods. Furthermore, the frequent neglect of woodlots often results in almost unrestricted hunting in these forests, and many fires, and this results in the destruction of the cover, and of many birds and other animals as well, which should be preserved, if for no other reason than on account of the help which they furnish in keeping down the superabundance of harmful insects.

NEEDED RESEARCH ON WOODLAND BIRDS

The present *Bulletin* summarizes our knowledge on the relation of birds to woodlots, and shows very clearly that the next logical step is to conduct detailed field research on the relation of birds to this kind of forest. The ideal location for such studies would be at a forest experiment station, where field conditions would be under control, and where a sustained policy, a permanent staff, and stable financial support, would permit investigations to be carried on continuously for a period of years. It even requires considerable time for a staff to become oriented on such a problem. A field laboratory should be nearby, adequately equipped with library, collections, and other facilities, so that the naturalist-forester would be in immediate touch with the forest conditions. There is really no substitute for this direct contact with field conditions. No researches on this subject have ever been conducted in America under such favorable cir-

cumstances as those just indicated; and one wonders how long it will be before such conditions will be provided. Such a field experiment station would also be suitable for other research on forest animals, and its acquirement would distinguish a new epoch in forest research.

LAND FOR THE ROOSEVELT STATION

The preceding remarks on the necessity of having tracts of land for conducting certain kinds of research, indicate an urgent need of the Roosevelt Station which is too fundamental to be passed over without further comment. The Station needs not merely a tract of land but several areas located in various parts of the State, and chosen with regard to their particular fitness for certain kinds of research. For example, forest land is needed for the study of deer and other big game, for research on the fur-bearing animals—both the upland and swamp kinds—and for the intensive study of fish culture in both lakes and streams. An excellent site might well be on Oneida Lake, as this is a large lake with a great variety of fish. Several miles of trout streams are needed, where under proper supervision, experiments could be conducted, so that within a few years valuable contributions could be made to our knowledge of this most popular and yet very imperfectly known fish.

How could progress in agriculture have been accomplished if the various experiment stations had not been provided with thousands of acres of valuable farm land? These stations own 20,000 acres of land and use 90,000 acres for experimental purposes.* We have in this country today 50 agricultural experiment stations, with staffs numbering about 2,400 persons. The total of the Federal annual appropriations for the fiscal year 1925 amounted to \$2,400,000 and State appropriation exceeded \$5,800,000, a grand total of over eight millions, and yet the Roosevelt Wild Life Station is the only Station devoted solely to forest wild life investigations! This poverty of facilities exists in spite of the fact that the wild life resources of the country are estimated to be worth about a billion dollars. How long will this condition last? Is it not time to provide, in an adequate manner, for both land and staff to aid in perpetuating such a resource?

*Data kindly furnished by Dr. E. W. Allen, Office of Experiment Stations, U. S. Department of Agriculture.

THE ROOSEVELT WILD LIFE MEMORIAL

As a State Memorial

The State of New York is the trustee of this wild life Memorial to Theodore Roosevelt. The New York State College of Forestry at Syracuse is a State institution supported solely by State funds, and the Roosevelt Wild Life Forest Experiment Station is a part of this institution. The Trustees are State officials. A legislative mandate instructed them as follows:

"To establish and conduct an experimental station to be known as 'Roosevelt Wild Life Forest Experiment Station,' in which there shall be maintained records of the results of the experiments and investigations made and research work accomplished; also a library of works, publications, papers and data having to do with wild life, together with means for practical illustration and demonstration, which library shall, at all reasonable hours, be open to the public." [Laws of New York, chapter 536. Became a law May 10, 1919.]

As a General Memorial

While this Memorial Station was founded by New York State, its functions are not limited solely to the State. The Trustees are further authorized to cooperate with other agencies, so that the work is by no means limited to the boundaries of the State or by State funds. Provision for this has been made by the law as follows:

"To enter into any contract necessary or appropriate for carrying out any of the purposes or objects of the College, including such as shall involve cooperation with any person, corporation or association or any department of the government of the State of New York or of the United States in laboratory, experimental, investigative or research work, and the acceptance from such person, corporation, association, or department of the State or Federal government of gifts or contributions of money, expert service, labor, materials, apparatus, appliances or other property in connection therewith." [Laws of New York, chapter 42. Became a law March 7, 1918.]

By these laws the Empire State has made provision to conduct forest wild life research upon a comprehensive basis, and on a plan as broad as that approved by Theodore Roosevelt himself.

Form of Bequest to the Roosevelt Wild Life Memorial

I hereby give and bequeath to the Roosevelt Wild Life Forest Experiment Station of The New York State College of Forestry at Syracuse, for wild life research, library, and for publication, the sum of, or the following books, lands, etc.

ROOSEVELT WILD LIFE BULLETIN, Vol. 2, No. 1. October, 1923.

1. The Control of Blood-sucking Leeches, with an Account of the Leeches of Palisades Interstate Park.....Dr. J. Percy Moore.
2. Preliminary Report on the Parasitic Worms of Oneida Lake, New York.....Dr. Henry S. Pratt.
3. Acanthocephala from the Fishes of Oneida Lake, New York.....Dr. Harley J. Van Cleave.
4. Current Station Notes.....The Director and Editor.

ROOSEVELT WILD LIFE BULLETIN, Vol. 2, No. 2. February, 1924.

1. Ecology of the Plankton Algae in the Palisades Interstate Park, Including the Relation of Control Methods to Fish Culture.....Dr. Gilbert M. Smith.

ROOSEVELT WILD LIFE BULLETIN, Vol. 2, No. 3. March, 1924.

1. The Status of Fish Culture in Our Inland Public Waters, and the Role of Investigation in the Maintenance of Fish Resources.....Dr. William C. Kendall.
2. Current Station Notes.....The Director and Editor.

ROOSEVELT WILD LIFE BULLETIN, Vol. 2, No. 4. February, 1925.

1. The Relation of Wild Life to the Public in National and State Parks.....Dr. Charles C. Adams.
2. The Big Game Animals of Yellowstone National Park..Edmund Heller.
3. The Food of Trout in Yellowstone National Park.....Dr. Richard A. Muttkowski.
4. Current Station Notes.....The Director and Editor.

ROOSEVELT WILD LIFE BULLETIN, Vol. 3, No. 1. February, 1925.

1. The Birds of the Yellowstone National Park.....Milton P. Skinner.
2. Current Station Notes.....The Director and Editor.

ROOSEVELT WILD LIFE BULLETIN, Vol. 3, No. 2. March, 1925.

1. The Muskrat in New York: Its Natural History and Economics.....Dr. Charles E. Johnson.
2. Current Station Notes.....The Director and Editor.

ROOSEVELT WILD LIFE BULLETIN, Vol. 3, No. 3. September, 1926.

1. The Summer Birds of Central New York Marshes.Aretas A. Saunders.
2. Additional Notes on the Summer Birds of Allegany State Park.....Aretas A. Saunders.
3. Current Station Notes.....Dr. Charles C. Adams.

ROOSEVELT WILD LIFE BULLETIN, Vol. 3, No. 4. October, 1926.

1. The Economic and Social Importance of Animals in Forestry, with Special Reference to Wild Life.....Dr. Charles C. Adams.
2. The Land-Economic Survey in Michigan.....R. A. Smith.
3. Current Station Notes.....Dr. Charles C. Adams.

ROOSEVELT WILD LIFE BULLETIN, Vol. 4, No. 1. October, 1926.

1. The Relation of Birds to Woodlots in New York State.....Waldo L. McAtee.
2. Current Station Notes.....Dr. Charles C. Adams.

